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Groupware Features to Your E-Mail

MAGAZINE

The Complete

Java

Can Java Compete
With Windows?

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The New Java
Applications and
Environments

Guide

What's Out There

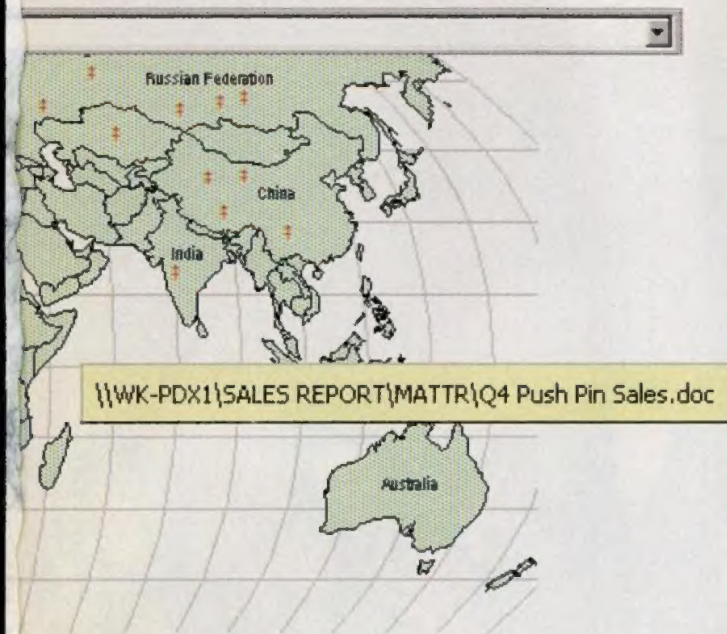
How to Use It

Do You Need It?





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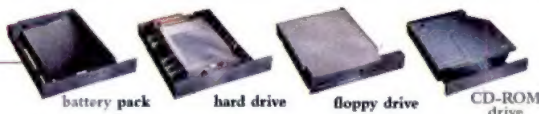
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The Rules of the Road



Sometimes it seems most of the world thinks the Internet is populated entirely by kooks and crazies. I am constantly being asked why there are so many cults on the Internet, why there is so much misinformation,

and how we can protect ourselves and our kids. Particularly after the Heaven's Gate mass suicide, the number

of questions has become overwhelming. It's getting a little tiresome.

As most of us know, the content on the Internet mirrors that of society. There's a lot of good, useful information on Web pages. Most of the communities and interest groups in chat rooms or newsgroups are for the public good, either as an exchange of useful ideas or just as a place for like-minded individuals to talk to one another.

There is a dark side, though. You can easily find pages of explicit or violent material that are offensive to many and are certainly not appropriate for young people. You can find pages that promote just about any cult, political group, or ideology—those that are socially acceptable and those that aren't (including some that may be harmful to impressionable viewers). You can find information that is irrelevant, inaccurate, or both. And you can run into some unsavory types of people in chat rooms, just as in real life.

Reality makes it necessary for us to understand some basic principles for communicating on the Internet. Most of these are fairly self-evident, and I suspect most of you know them, but it can't hurt to refresh your knowledge.

Rule 1: Know where you are. One great thing about the Web is that links can take you to many sites that you might not otherwise visit or even know about. That's good, but the downside is that you can begin at a site that contains trustworthy information and follow link after link until you get to a page that contains dubious or deceitful information. Make sure that you're in a familiar place. You probably wouldn't walk around a big city without some idea of where you were, and the same applies to the Web.

Rule 2: Know whom you are talking to. In the same vein, when you get to a new site, you should be sure you know who posted the information. Is it an organization that's known to you? Or someone new and perhaps less reliable? A friend or maybe a new acquaintance? Remember that even on sites maintained by large organizations, postings in chat areas or

newsgroups may not be dependable. And in many cases, chat groups are composed mainly of anonymous or pseudonymous people.

Rule 3. Watch your children. In today's world, you wouldn't let a small child wander off in a strange city—or let young teenagers go wherever they liked, with no supervision. You shouldn't do the same things on the Web. Parents should guide their children on their early trips to the Internet. For many children, filtering software is quite appropriate—and many parents find comfort in the logs many of these programs keep that show where the child has visited.

Rule 4. Don't reveal too much about yourself. It's great to go into chat rooms and discuss your opinions, and all that. But *never* give out personal information, such as your home phone number or address, to someone you don't know. It is most important that you teach this to your children; as in the real world, there are some dangerous people in cyberspace.

Rule 5. Guard your money. Never give out your credit card number to someone you don't know. While instances of credit card fraud on the Internet are much less frequent than in the real world, fraud can happen. Know who is receiving your money, and specifically what you are getting for it.

Simple rules, but important. Most of them seem readily apparent. But I've met too many people who have inadvertently run into trouble because they haven't followed them.

A stylized, handwritten signature of Michael J. Miller in black ink.

MICHAEL J. MILLER



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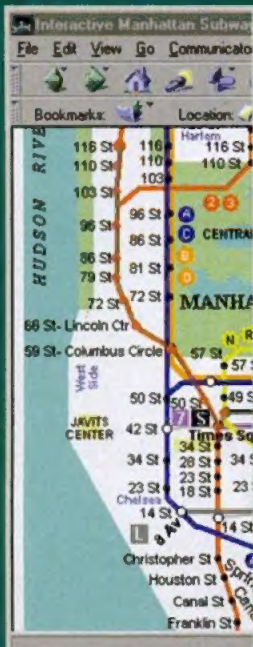
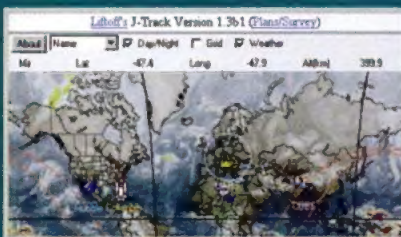
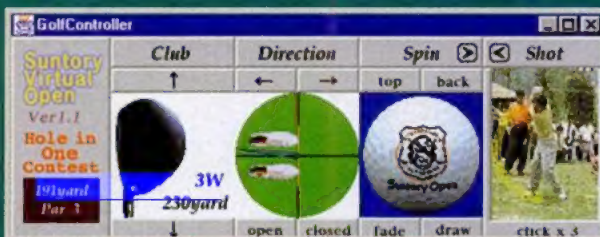
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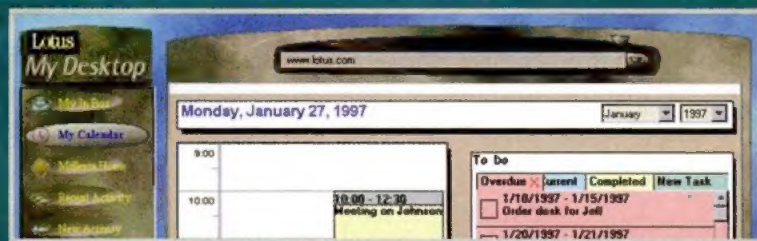
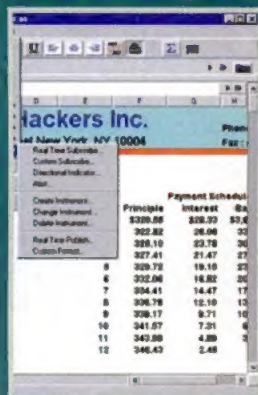


Java: A Field Guide for Users

BY RICHARD V. DRAGAN AND LARRY SELTZER

You've heard all the buzz about this hot technology. Now hear what it actually can and cannot do for you right now. We review Java productivity applications and test all the Java virtual environments100

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ONLINE



What's New Online

The Top 100 Web Sites

It's spring cleaning time for the

editors who prepare our quarterly list of the Top 100 Web sites. They've been checking out the latest and greatest sites, and you can surf through their selections at www.pcmag.com starting May 4.

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GROUPWARE

Multiple Personalities



BY TONY POMPILI Today's groupware packages have evolved into multidimensional communications and collaboration systems that offer rich proprietary development while embracing the Internet's open standards and protocols. Here's our in-depth look at the big four as they move out to the Web. We show you how they balance proprietary and open worlds and handle both native and open clients....117

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WEB SERVERS

Beyond Unix

BY TODD E. COLUMB

Most servers currently sitting on the Web are Unix-based. But that's not where the growth in new Web servers is likely to be. Windows NT Server, for one, is emerging as a strong base for your next Web server. Your decision about hardware and software will undoubtedly be influenced by the expertise you have in-house. We review 16 combinations of platform, OS, and Web server software to help you make the best choice....167



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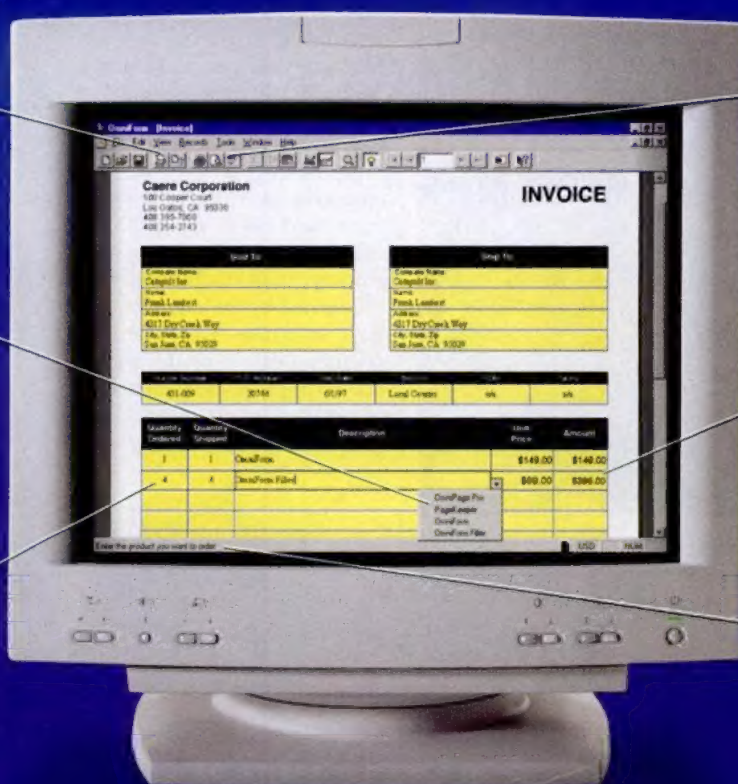
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Pipeline

A Tale of Two Bookstores

This Web potboiler should be a real page-turner. Just one month after online bookstore Amazon.com filed for an initial public offering valuing the company at \$299 million, bookstore behemoth Barnes & Noble has arrived on the scene with its own

The number of books in stock—that is, available for immediate delivery—will likely be a competitive issue as well. Steve Riggio, CEO of Barnes & Noble, says the company has invested \$20 million in a distribution center that will warehouse 400,000 titles. By fall, the company expects to offer a next-day delivery option on every title.

Amazon.com doesn't publicize the number of titles in its warehouse. Yet it already has an established presence on the Web and a loyal following. By the end of 1996, it had sales of over \$16 million to approximately 180,000 customers, and repeat customers account for over 40 percent of orders.

Worldwide book

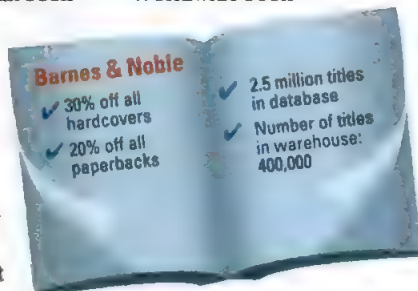
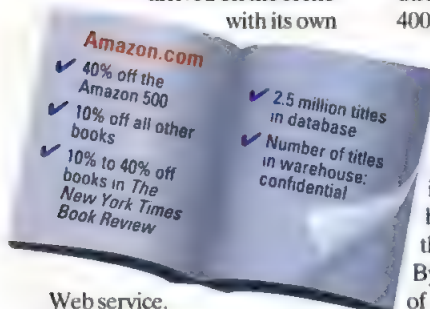
Web service.

Both companies are aggressive marketers, and both contend that no one will outgun them on price.

But that depends on what book you want. Amazon.com offers 40 percent off its "Amazon 500," a list compiled by Amazon editors that includes best-sellers as well as up-and-comers. The company discounts any book in *The New York Times Book Review* by 10 to 40 percent and all other hardcovers and paperbacks by 10 percent.

Barnes & Noble offers discounts of 30 percent for all hardcovers and 20 percent for all paperbacks.

sales are expected to hit \$90 billion by 2000, and the competitive environment on the Web could turn out to mean better prices for book lovers everywhere.



"The number of platforms for Internet access will increase dramatically between now and the year 2000, with Internet access devices of all kinds found in airports, coat pockets, and elsewhere. They'll be as ubiquitous as telephones."

—Digital Equipment Corp. chairman **Robert Palmer**

Internet Inn

Now that more hotel rooms are being wired to the Internet through in-room PCs and TVs, it won't be long before business travelers start choosing hotels based on the Internet services rather than the food or the views.

LodgeNet Entertainment is extending its b-LAN network, which pumps movies-on-request into in-room TVs, with Internet access. Its version of a NetTV requires a central device that houses the browsing software and delivers Internet access, upon request, to a room's TV. The company has teamed up with Diba to provide the application architecture. It's exploring a variety of pricing models, including the use of advertising to enable

free access, charging for premium content, and charging by the hour.

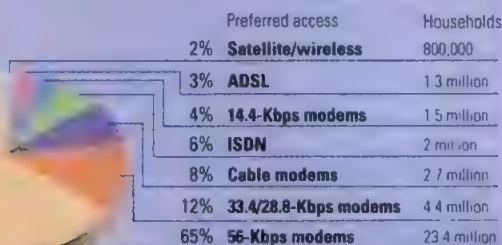
Using a LodgeNet remote control and on-screen keyboard, hotel guests can access the Web and navigate to work-related sites or to spots for local information. LodgeNet began a pilot program for its Internet services at a Sioux Falls hotel in February.

Meanwhile, 4th Networks has already installed T1 lines for high-speed Internet access in the lobbies of several San Francisco Bay area hotels. And sometime this spring it plans to provide high-speed Internet access, through in-room PCs, to guests of the Hyatt St. Claire in downtown San Jose, the Hyatt San Jose Airport, and the Sherman House in San Francisco.



Modems Won't Hang Up Soon

By the year 2000, dial-up modems will still be the most popular method of accessing the Internet in the U.S., according to Jupiter Communications. They'll be used to connect about 80 percent of the households online.



Source: Jupiter Communications.

Online: Intranet Explosion

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Has your boss put you in charge of building your company's intranet? Join us online for in-depth analysis of today's best intranet options, with extended coverage of intranet servers, groupware tools, and mail servers. **THE TOP 100 WEB SITES, NEW FOR MAY:** We dispatched a team of ten editors to find today's best Web sites. Take a guided tour of their intriguing selections and scan the list of sites that have won three, four, and five times, starting May 4.

ALSO ON THE WEB: Check in every day at our NewsWatch page to catch up on the latest Trends and news analysis, late-breaking new-product announcements, and our daily summary of computer coverage from the mainstream press, News.Scan.

Pipeline

HTML Gets a Jolt

Like a single-sex college on a Friday night, the Web is woefully lacking in lively interaction. But a new technology dubbed *Dynamic HTML* promises far more user interactivity on the Web than HyperText Markup Language (HTML) currently allows; it's poised to spice up static Web pages in a big way. The World Wide Web Consortium (W3C), an international organization charged with developing common Web standards, is now considering proposals for the specification.

HTML has served the Web well, but it has its limitations. Plain old HTML produces flat, staid pages, mainly because it requires you to request data from a server when you want to see hidden content. Until now, HTML extensions, plug-ins, applets, animated GIFs, JavaScript, and VBScript have addressed the problem. In some cases, though, these solutions

are difficult to develop, and they lack a universal standard.

Browsers with built-in support for Dynamic HTML will let you see Web pages' hidden material on the fly, without server requests.

Both Microsoft and Netscape have submitted technical Dynamic HTML proposals to the W3C. Netscape uses a "layering" technique, which sends

vast amounts of layered code to browsers, where portions of the content stay out of sight until needed. Microsoft's method calls for "cascading stylesheets," where photos or illustrations, for example, might appear as you move your mouse cursor over certain parts of the screen.

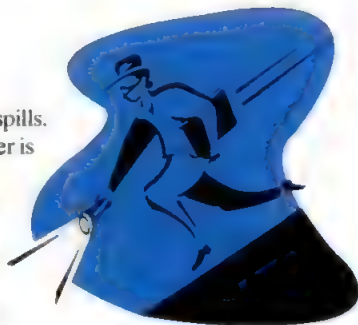
Although Microsoft and Netscape are courting the W3C with their blueprints, both camps will most likely adhere to the W3C's specification down the road.



Notebook Abuse

Falls, vibration, dust, coffee spills. Life as a notebook computer is tough. And last year was an especially bad one, with more notebooks damaged and stolen than ever, according to computer insurer Safeware Insurance of Columbus, Ohio.

Theft and accidental damage are the major causes of notebook computer losses. The costs of accidental damage exceeded \$291 million last year, an increase of 53 percent over the previous year. "Every time a computer is thrown in a briefcase or pulled from an overhead rack, there is an accident claim waiting to happen," says David K. Johnston, Safeware's CEO. And according to the company, notebook theft was up 26 percent from 1995, accounting for losses of around \$805 million.



THIS ISSUE'S CONTRIBUTORS: Angela Hickman, Carol Levin, Cade Metz, Sebastian Rupley, Michael E. Ryan, and Don Willmott.

Humongous TV Deal

Look for computer characters Putt-Putt, Freddi Fish, Pajama Sam, and the rest of their friends to make a historic appearance on your TV screen sometime in the fall of 1998. As they make the leap from digital to conventional media (it's usually the other way around), you may see "Putt-Putt the Animated Series" on TV, Freddi Fish pop-up books, and Pajama Sam plush toys.

Humongous Entertainment and Lancit Media Entertainment recently agreed to create TV shows, movies, and home videos based on the characters from Humongous's award-winning line of children's software. Lancit will serve as the exclusive licensing agent for the

characters; so don't be surprised if your kids start begging for giggling Pajama Sam action figures or Freddi Fish lunch boxes.

A few notable properties—including Broderbund's Carmen Sandiego, Origin's Wing Commander, and Sega's Sonic the Hedgehog—have already made the jump from digital to conventional media. The

Humongous/Lancit announcement, however, marks the first time that an entire family of characters has done so. The deal could very well move

Putt-Putt and pals into the leading ranks of children's characters, alongside such heavyweights as Rugrats, Barney, and the Disney characters.



All-in-One Web Phone

Can't decide between one of the newfangled cellular phones that offer Web access and one of the new hand-held computers that offer miniature desktop applications? Nokia has a solution that combines both functions. The Nokia 9000 Communicator, available this summer, looks like a regular cellular phone until you flip open the cover to reveal a terminal for e-mail, the Internet, and faxing. Applications include a Web browser, address book, contact manager, and notepad.



The product uses an Intel 386 microprocessor, runs the GEOS operating system, and stores 2MB of data. A GSM version is available in the U.K. for around \$12,000. Nokia has not yet firmed up a price for the U.S. version.

Top Retail Business Software

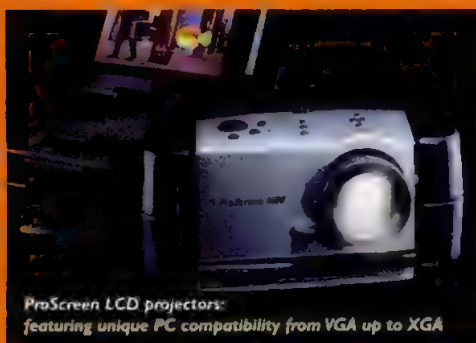
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- 2 Viruscan McAfee
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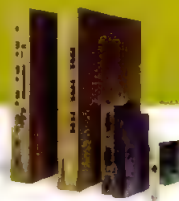
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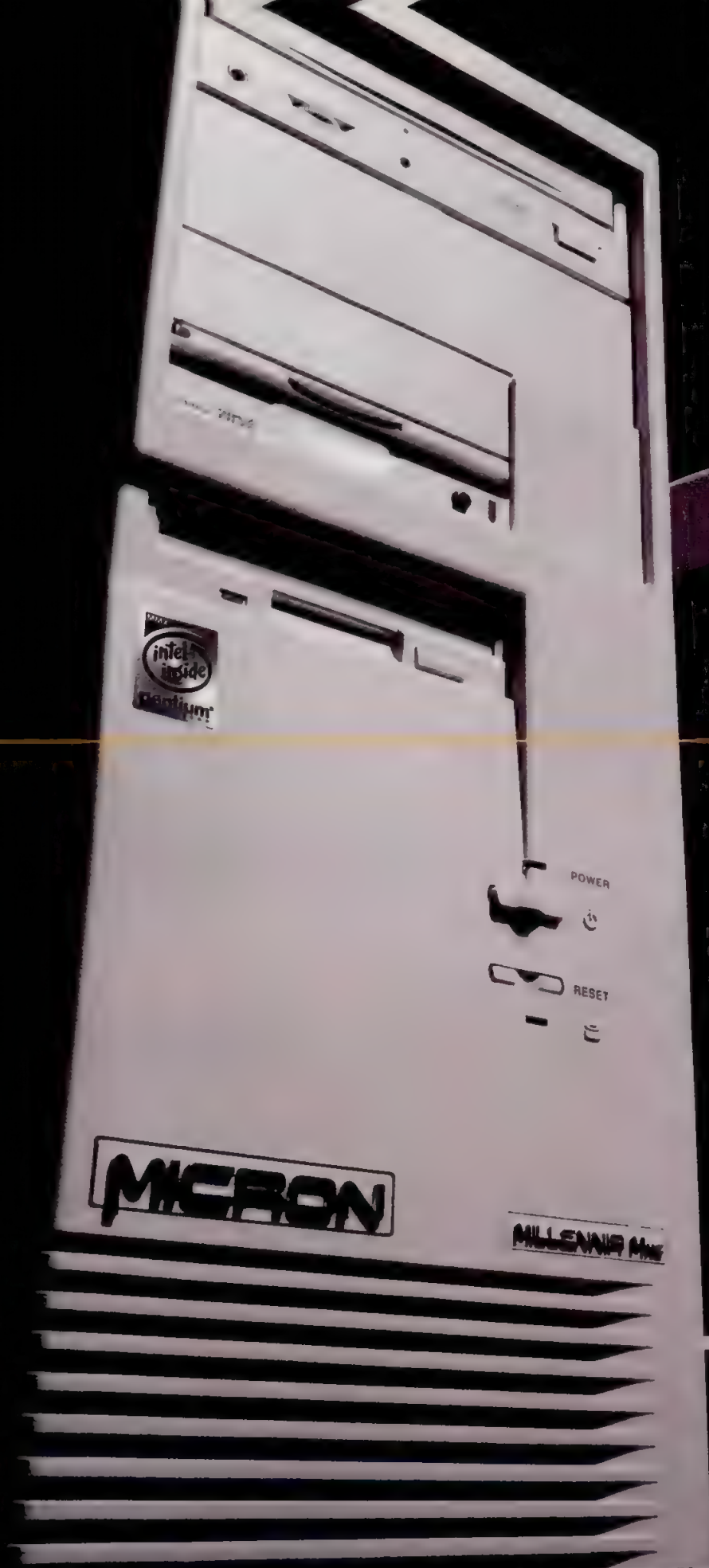
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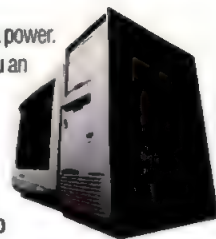
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Letters

DRIVEN BY SCANNERS

I enjoyed your article on flatbed scanners ("Capture the Color," March 4, 1997), and I especially liked your comments on the Hewlett-Packard PictureScan driver. It's too simple, too limited, and too frustrating. I had to download the DeskScan driver to get the full potential out of my purchase. As an OS/2 user, I felt that you should have mentioned whether there were drivers for OS/2 as well. I bought an HP 4p a few months ago because it was one of the few scanners that had OS/2 support via a third-party driver, and then HP changed its SCSI card to a Symbios Plug and Play card that uses a different IRQ setting in OS/2 Warp.

MIKE PALMER
via the Internet

As a Windows NT 4.0 user, I have suffered because scanner drivers are not as available as with other operating systems. Thus it was somewhat disappointing to see that Windows NT driver availability was not a criterion nor even reported on in your comparison of scanners. However, I can cheerfully report that the VistaScan drivers and associated software for your Editors' Choice, the UMAX Vista S-12 scanner, have been upgraded to support Windows NT 3.51 and 4.0.

JEFF DE LUCA
via the Internet

I was disappointed that you reviewed only the UMAX Vista S-12 and not the S-6, since the S-6 more closely matches my requirements. After all, you reviewed three Agfa models, two from HP, two from Nikon, two from Mustek, and two from Microtek. Also, I felt that it was unfair to review 300-dpi and 600-dpi scanners together, since their target markets differ.

WAIMAN LEE
via the Internet

The latest version of the UMAX Vista S-6, the Vista S-6E, was not ready in time to be included in our roundup. We reviewed both 300- and 600-dpi units together so readers could see the range of choices available to them and match the scanners' abilities to their needs.—Ed.

"Capture the Color" was great, and the online version with output samples is a nice touch. But I would have liked to download the original image that was used for testing.

JAMES SULLIVAN
via the Internet

Since the original image is an 8-by-10 color glossy photograph, it would be inconclusive to download a scanned copy.—Ed.



"I enjoyed your article on flatbed scanners, but you failed to discuss driver availability."

I enjoyed the flatbed scanner review article, but it's mind-boggling that simple scan times were not reported for each model.

WAYNE FULTON
via the Internet

I wish you'd cover dedicated film and slide scanners in the future. I am an amateur photographer and would like to scan my slides.

ADRIAN STARMER
via the Internet

FORWARDING IN THE FUTURE

I visited the Bigfoot site ("Never Change Your E-Mail Address Again," Trends, February 4, 1997, page 40), signed up, and was pleasantly surprised that the e-mail-forwarding service is free. However, I am a bit leery of what might happen if I distribute my new address to all of my associates and then Bigfoot has problems or goes out of business. This type of forwarding is sorely needed, however.

DAVE SALAH
via the Internet

WHAT TOOK YOU SO LONG?

In "Waiting for 2000" (Trends, March 4, 1997, page 29), you mentioned the turn-of-the-century dilemma that mainframe owners and programmers are facing. Didn't they know about this problem years ago? Why now, with only a few years left, are they doing anything about it? I think that anyone who has not upgraded, reprogrammed, or found another solution deserves to lose a lot of money.

MARC A. JOHNSON
via the Internet

You did your readers a real disservice with the article "Waiting for 2000." PC users should be as concerned about the year 2000 as their mainframe counterparts, especially considering the dispersed nature of personal computing versus the central control in the mainframe arena. Microsoft is providing a solution in its newest version of Access, and other vendors, including mainframe software companies, are taking similar steps. Another problem is that the BIOS in many older PCs will cause the internal date to roll over to January 1, 1980, after December 31, 1999.

JOSEPH LEUBITZ
via the Internet

SOFTWARE FORUM

Bill Howard had many complaints about software in his March 4, 1997, column ("Software Snafus"). He should get down on his knees and thank the developers who have brought us the software that we have. Sure, I have a few complaints myself, but when I started programming, one had to write code in numerics, keep track of memory locations, scale numbers (no floating point), and even wire control panels.

BOB LAFARA
via the Internet

Howard is absolutely right about the PC's annoying limitation of having only 16 interrupts, 2 COM ports, and 1 printer port. The main problem I'd like to see solved, however, is the one created by multilevel dialog boxes. If you're in the middle of changing the formatting on a spreadsheet, you have to keep drilling down through the same series of dialogs to get to the right place.

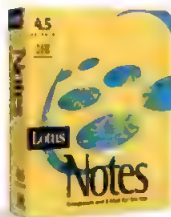
DAVID W. KUNKEL
via the Internet

Howard's comments on software and hardware deficiencies were right on. Software companies should ask for ideas on improvement instead of for demographic information on registration cards. And when they do ask, "What can we do to serve you better?", they leave only a 1-inch line for the reply.

ART JACKSON
via the Internet

HAND ME THE REMOTE, PLEASE

At work, I develop Java applications to connect high-end databases to the corporate intranet at one of the largest telecommunications companies in North America. At home, I use a Sony WebTV ("Tuning In to the Web," February 18, 1997). The ease of use of this device exceeded my expectations so much that my laptop is no longer what I use for personal e-mail. When I'm home, I just



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Letters

punch the "Web" and "TV" buttons on the remote control, and I'm connected within about a minute. Then I just browse the Web and read e-mail from my couch. Your analysis of these boxes is right on. I was happily surprised to find that the Sony was the fastest of the WebTV terminals.

MATTHEW WOLKENBERG
via the Internet

WEAVING THE WEB

Your article on Web page editors ("Grand Designs," March 4, 1997) was very helpful. I downloaded AOLpress 1.2.3, and within an hour I had completely redesigned my Web page. Before, I was using HoTMetal PRO 2.0 to publish Web pages. It was fine for a while, but it didn't have the current features one looks for in an HTML editor.

TIM MALYSZKO
via the Internet

I totally agree with your picking Microsoft FrontPage 97 as your Editors' Choice but disagree with your description of NetObjects Fusion as an "enterprise Web authoring tool." You herald Fusion's "pixel-perfect editing capabilities" as the best thing since sliced bread. I personally regard this feature as one of its major flaws. Since this feature requires every single page to consist of a pixel-dimensioned table, a Fusion-created site looks downright laughable when viewed in a resolution higher than 640-by-480. In short, using Fusion for a corporate site automatically ridicules the site owner in the eyes of a significant and growing number of IT professionals.

SJOERD VERWEIJ
via the Internet

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CORRECTIONS AND AMPLIFICATIONS

In the March 25, 1997, article "Looking Back," we incorrectly identified the operating system Microsoft acquired and turned into MS-DOS. The code name for the product was QDOS, as noted in the article, but the official name was 86-DOS. The correct spelling of the name of the original operating system's author is Tim Paterson.

In our First Looks article "The Lifetime Mailbox" (March 4, 1997, page 76), we should have noted that Bigfoot for Life works with Internet mail.

A GRABBING UTILITY

Thank you for publishing the utility FileGrab ("FileGrab: The Missing Link," Utilities, March 4, 1997). Your PC Tech section continues to be of enormous benefit.

RONALD ELIGATOR
via the Internet

ROBOT TALK

The scenario that John C. Dvorak paints in "Where's My Robot?" (March 4, 1997) is not for me. I don't think many people could afford a robot today, and if they had one, they'd probably have a more sedentary lifestyle than ever. With all the little things that can and do go wrong with computers today, would you trust your household to a robot?

GODFREY CHRYSOVERGES
via the Internet

Several research universities such as mine have been studying robotics for years. I've seen demonstrations of a robot turning an object around in its "hand." But such robots are imperfect, clunky prototypes—nothing you would want in your house. Furthermore, although much has been done in the area of robot vision, technology like this that could land in your home is far off in the future.

RICH GOLDBERG
Rochester, New York

The technology certainly exists to create useful household robots, but I don't think that the lack of computational means has ever been the question. Rather, it's the tremendous bounty of ability within our own heads that has let the PC outstrip other possibilities. While PCs can immediately reflect new technology with new software that will take further advantage of the human ability to interpret symbols, new technology can't explode onto the scene the same way when it has to confront the hard, nonsymbolic realities of physics.

JONATHAN HOGG
via the Internet

NEED MORE INFORMATION

You were far too kind in your review of the Britannica CD 97 encyclopedia ("Information, Please," First Looks, March 4, 1997, page 45). You casually mention that lengthy articles are difficult to read and print. That's like reviewing top-of-the-line luxury cars and casually mentioning that one of them runs on

a two-cylinder engine. Articles are cut up into too many individual HTML pages. Reading and printing can only be done one HTML page at a time.

JAY SEAVER
Longmont, Colorado

I can't believe your article actually said that "it's time to throw away those printed encyclopedias." Need I point out that power outages happen but education and research must go on? I also can't believe that the review focused on the usual features of software that one would expect, along with the usual bells and whistles, but without actually saying anything about the quality or accuracy of the information provided.

COLIN SACHS
via the Internet

COOKIE MONSTERS

Of late, I find myself bombarded by a constant barrage of "cookies" from every Web site I visit. I'm sure I'm not your only reader who is quite concerned about having large numbers of these on my hard disk and not knowing what they are doing or perhaps worse, what they might be doing. How about an in-depth article about cookies, revealing their actual purpose as well as their dark side?

JOHN PETERS
via the Internet

MISUNDERSTOOD

I felt that the article "Out of the Darkroom" (March 4, 1997) failed to portray the Polaroid PDC-2000 digital camera as designed for users who require high-quality output and ease of use. In addition, it is targeted at commercial users who cannot afford to spend \$10,000 dollars on a professional digital camera. Because Polaroid is committed to providing these specifications, the PDC-2000 is the only point-and-shoot camera in its price category to provide the unsurpassed, photo-realistic image quality of other cameras. The PDC-2000 is an ideal solution for the general business, desktop publishing, and image database application segments. Unfortunately, it is compared in the article with the functionality of an SLR camera.

SUSAN WILLARD
*Director, Input Services
Polaroid Digital Imaging
Cambridge, Massachusetts*

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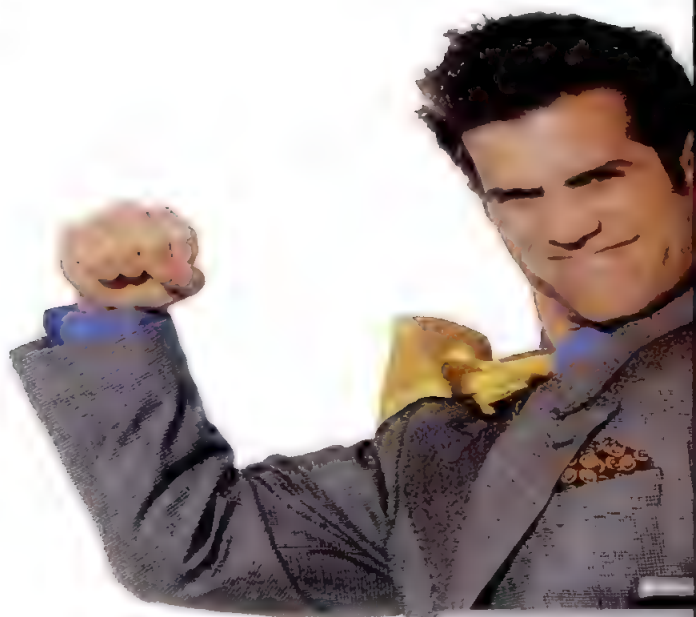


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Trends



Microsoft and Netscape Get Pushy

Two Web broadcast strategies aim to control your desktop. Do you want that?

One of the most far-reaching attempts to change user interfaces in years is underway as Microsoft and Netscape release details of their respective plans to make broadcast, or push content, not only the new interface metaphor for Web browsing but an interface for the desktop itself.

Microsoft's Active Desktop will integrate the Internet Explorer 4.0 browser and the next version of Windows—code-named Memphis—into one broadcast-oriented interface. It's expected to face a challenge from Netscape's Constellation, Mercury, and Apollo technologies, which will also focus on broadcasting content straight to the desktop. The face-off between the two companies is setting off skirmishes over standards for push content and inspiring several new industry partnerships.

At the recent Internet World trade show in Los Angeles, Microsoft's Brad Chase announced support from over 30 vendors for Microsoft's new Channel Definition Format (CDF) technology, which Microsoft will build into Internet Explorer 4.0 as well as Memphis. Microsoft wants to make CDF a standard for broadcasting content—such as tickers of news headlines—from the Web directly to your desktop. PointCast, BackWeb, AirMedia Live!, and other companies are backing CDF.

"All of the different user interfaces for push content make it hard to know what to do," Chase said. "This new

standard is designed to create one way to design and to Webcast content to Internet Explorer 4.0 users."

Netscape's Constellation, slated for release this summer, is a Java-based interface that organizes the desktop into channels of push content. It provides for, but does not emphasize, access to the file system—a central feature of previous desktop interfaces. After you select the sources of the data pushed to your desktop—such as Web-based news or financial sites—Constellation will regularly update the data from the Web directly to the desktop.

Later this year, Netscape will also deliver its Mercury and Apollo extranet technologies, designed to help corporations build Web-based infrastructures to communicate with other businesses and customers. Mercury will

extend the push metaphor in Constellation with an agent-based technology, code-named Compass, to filter online information automatically. A server suite featuring push content, code-named Apollo, will replace the company's current offering, SuiteSpot.

The biggest difference between Microsoft's Active Desktop and Netscape's push products is that Microsoft's push interface will be grafted directly onto the Windows desktop, while Netscape's Constellation—as well as its upcoming Mercury—are positioned as crossware, cross-platform desktops. Constellation, as shown so far, looks more server-based than Active Desktop, so you can log in to your desktop from any computer.

"Rather than focusing on one platform, and incorporating lots of operating system metaphors, we want to make the information itself the interface," says Netscape product manager Alex Edelstein. According to PointCast CEO Chris Hassett, speaking at Microsoft's Channel Definition Format announcement, "1996 was the year the broadcast metaphor for Internet content achieved viability, and it will remain on the rise."

The certain beneficiaries of the face-off over which brand of broadcast-oriented desktop users will favor—Microsoft's or Netscape's—are content providers. One way or another, Web content seems headed straight for the desktop.—Sebastian Rupley

Mark Your Calendar

1997

Microsoft Internet Explorer 4.0
New version of Web browser, to incorporate Active Desktop and push content
Q2 1997

Microsoft Memphis
New version of Windows OS, to incorporate Active Desktop and IE 4.0
Q4 1997

Netscape Mercury
Corporate extranet software, to add agent-based search technology to Constellation
Q4 1997

Netscape Constellation
Desktop manager within Netscape Communicator, to deliver push content and file management
Summer 1997

Netscape Apollo
Server suite, to emphasize push content for corporate extranets
Q4 1997

Find It, Then Buy It on the Web

The latest advances in cybershopping.

When was the last time you bought something using the Web? Despite all the hype, Web commerce isn't exactly taking off like wildfire. But the challenge is inspiring developers and entrepreneurs to come up with technologies that will sell consumers on cybershopping.

At the recent PC Forum conference, one of the industry's elite yearly events, a Seattle-based software start-up called Netbot demonstrated Jango, an intelligent-agent-based online shopping application. Based on a unique search technique that uses a "parallel aggregation engine," Jango—which works within either Microsoft Internet Explorer or Netscape Navigator—finds the stores on the Web that carry a product you want and locates the sites that post reviews of the product. Netbot sends parallel requests for information on a product, so you don't have to conduct time-consuming sequential searches.

According to Netbot's Eric Zoher, the company intends to extend its parallel aggregation technology to other applications, such as polling company sites for job search information or searching Web sites for financial news. The company plans to make Jango available as a free download this summer.

The Internet Mall, which is already one of the biggest Web shopping sites, has developed a transaction system that will enable people to sell goods over the Web without worrying about the nuts and bolts of electronic retailing. Anyone with as few as ten products to sell can pay a start-up fee as low as \$100 to become commerce-enabled. All you have to do is add a "Buy Now" button to your Web page and the link goes back to The Internet Mall, where all the database and credit-card authorization takes place.

With The Internet Mall's new "Order Easy" system, shoppers will be able to take a virtual shopping cart all around the Web, adding any desired items to it whenever they see a "Buy Now" button on a site. If the system works as described, Web shopping could become even more convenient than a trip to a climate-controlled mall. The only thing missing will be the food court.—*Sebastian Ruppel and Don Willmott*



Java: Write Once, Run Mostly

ACCORDING TO SUN MICROSYSTEMS' marketing campaign, perhaps the most important argument for Java's *raison d'être* is its portability. While other programs are composed of instructions specifically designed for a certain type of microprocessor, Java doesn't require developers to rewrite the same programs for different platforms.

Java programs are written for an imaginary microprocessor, called the Java Virtual Machine (Java VM). It reads and translates instructions into native code for a specific platform, such as Windows 95. For this reason, any Java program can run on any computer for which the VM translation program exists. Or so the theory goes.

For this issue, PC Labs ran performance tests on 21 Java VMs from five different vendors on seven different operating systems. This was perhaps the most ambitious cross-platform testing project we have ever attempted. In the past, testing on so many platforms required a lot of special programming. Java's cross-platform capabilities promised an end to all that. They mostly succeeded, but not as much as you might think.

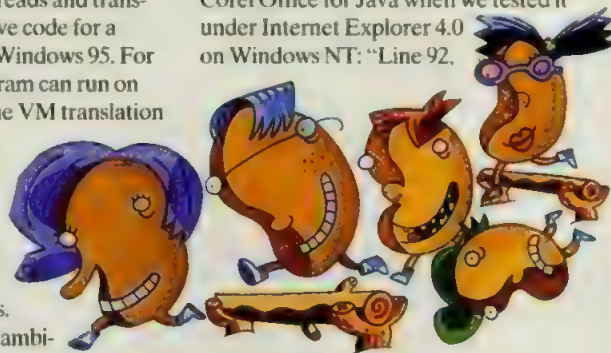
There's a lot more to Java's portability than just translating instructions. Java isn't just a set of instructions; it's also a library of objects that programmers can use for basic programming. The behavior of these libraries must be consistent across implementations or programs will work on one platform and not on another.

In one test, for example, we composed an unusual but perfectly legitimate call to Java's graphics library, using a method called `drawImage`. The routine draws a bitmap image on the display using negative coordinates. The graphics library is supposed to follow up with another call (`imageUpdate`) to give the application an opportunity to modify the drawing process. Some VMs did not perform the latter call, since the first used negative coordinates; some did. As a result, our test locked up on some VMs. Although we were able to work around this problem, we shouldn't have had to: Our code was 100

percent pure and legal Java. And this wasn't the only problem we encountered.

Failures in Java can be mysterious, often resulting in the VM's locking up internally. In these situations debugging becomes a guessing game.

Testing third-party Java applications and applets revealed similar nonuniform behavior among the programs. For instance, we received the following error message from Corel Office for Java when we tested it under Internet Explorer 4.0 on Windows NT: "Line 92,



Char 2 Error: Object doesn't support this property or method, Code: 0.... Line: 173, Char: 1, Error: Unspecified Error, Code: 0". Needless to say, the programs included in the test crashed a lot, and for a variety of different reasons.

JDK 1.1 TO THE RESCUE?

Incompatibilities are not uncommon, and there is reason to believe that things will only get worse in the future. Sun's new Java Development Kit (JDK) 1.1 introduces scores of new facilities and hundreds of new behaviors that must be implemented by all the VM vendors in a consistent way for Java programs to run correctly.

When two VMs behave differently, how should software vendors respond to their incompatibilities? In some cases the Java specification can define the correct behavior. In practice, however, the most important products—Microsoft Internet Explorer and Netscape Navigator—determine the correct behavior.

The bottom line: If a Java program hasn't been tested for correct behavior on a particular Java VM, you cannot assume that it will work.—*Richard Dragan and Larry Seltzer*

Trends

Can the Web Hurt Schools?

Author Michael Crichton and FCC chief Reed Hundt spar at PC Forum.

Midway through the recent PC Forum conference in Tucson, Arizona, *Jurassic Park* author Michael Crichton and chairman of the Federal Communications Commission Reed Hundt got into a debate on technology's role in the educational system. Crichton opened with a foreboding set of predictions about how Internet access for school-age children could undermine, not help, education in America.

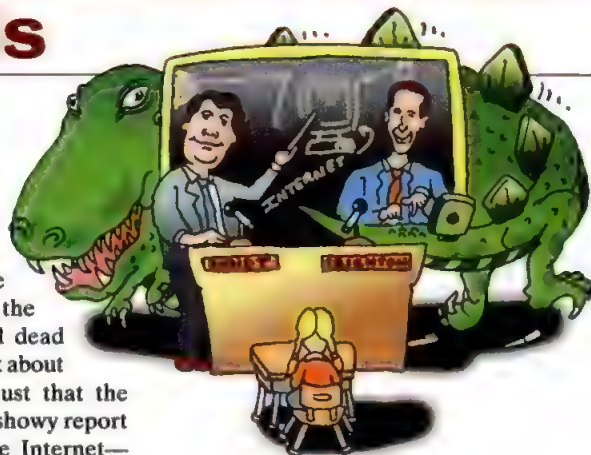
Hundt argued vehemently against Crichton's assertions, firing off a hailstorm of data contradicting Crichton. "I thought Michael Crichton's speech last night was to education what *Jurassic Park* is to cloning," said Hundt. "The speech was completely false, but highly entertaining."

During his speech, Crichton showed a video clip from Microsoft that depicted a student delivering a multimedia research report on Mayan civilization. The child had built the report's elements from the Internet.

After the clip, Crichton surgically took apart the facts in the child's report, characterizing the report as heavy on glitz and dead wrong on facts. "The worst part about this," Crichton said, "isn't just that the teacher—impressed that this showy report was built with the aid of the Internet—praised it, but that nobody at Microsoft knew that the facts were wrong."

Crichton asserted that those who support bringing the Internet into the classroom aren't thinking about training issues for students and teachers. "There is a lot of data supporting the idea that technology does not make a difference in classrooms," Crichton said.

"It is true that we need to evaluate what the Internet actually is, whether it's more analogous to a library or cable TV," said FCC Chairman Hundt. Hundt proceeded to counter Crichton with data. He said that by



the year 2000, 60 percent of new jobs will require computers and networking skills. He also said that only 14 percent of U.S. classrooms have Internet connections, with those connections mostly in affluent school systems. According to Hundt, only 4 percent of rural, low-income households have access.

Hundt is currently backing a bill that would require \$4.25 billion to Internet-enable schools. Surcharges on telecommunications companies, as well as charges to federal funding for education, would support the fund.
—Bill Howard and Sebastian Rupley

JAKE KIRCHNER

Warning: No Lifeguard on Duty

One year ago in this space, I suggested that many of the media companies then plunging into online publishing would find the Internet waters cold and rough. It was clear that—given the relatively few dollars available for Web advertising—most television, magazine, and newspaper companies would find they had two choices on the Internet while hanging on for the growth of online advertising: resign themselves to long-term investment strategies or rely on subscription or pay-per-view models for short-term revenues.

It was hardly a ground-breaking prediction. Everyone in the business knew there were not enough advertising dollars available to fund the traditional ad-based businesses for the hundreds of publishers rushing to the Web. It was not then—and is not now—a game for the weak-willed or poorly financed. They all knew that going in.

Even so, it's surprising how many media musclemen have pulled back shivering from their quick and timid dip into online publishing. Perhaps the most celebrated recent failure is Politics Now (a joint Web venture of *The Washington Post*, ABC News, and *National Journal*), which shut down after a brief, unprofitable run. And a number of other leading companies have sharply curtailed their investments or turned to subscription models to stem their losses.

For example, for several months now *The Wall Street Journal* has been charging \$49 a year for a subscription to its Web service, which had originally been free. This from a company that reportedly is willing to pony up an additional \$350 million or so in investment in its less-than-scintillating online information service Telerate. In an-



other example, Time Warner is constantly rumored to be reconsidering the wisdom of its Pathfinder service, which is reportedly losing more than \$10 million a year.

That \$10 million sounds like a lot of money, but it's only a fraction of what these now-timorous publishing magnates are used to spending on start-ups and acquisitions. Gannett is said to have spent more than \$600 million on *USA Today* before it achieved profitability. Even minor players routinely invest tens of millions of dollars over five to eight years on an average magazine start-up.

Yet these same companies, which look with horror at Microsoft's commitment to pouring \$400 million or more into its online services, are now folding their lounge chairs and heading home.

What gives? What is it about the Web experience that's making weaklings of all these media giants? My own view is that they're fleeing not so much from the continued losses in online publishing as from their own lack of knowledge of the Web's underlying technologies, as well as from their understandable uncertainty about the future viability of online ventures. In the face of their shareholders' concerns as to predictable profitability, they're quick to retreat to the past. They know they can make money in print, and they know how to do it. They don't know if anyone can make money online, and they haven't a clue how to do it themselves.

On the other hand, I'm absolutely convinced that out of the maelstrom of browsers, search engines, Web channels, push technologies, 3-D chat rooms, and interactive multimedia gizmos, there will emerge a mode of online publishing that will completely swamp the staid print and broadcast industries, now content to build castles in the sand.

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Introducing the MessagePad 2000, the only handheld computer you can actually use.

Of all the handheld computers, only the MessagePad 2000 offers sharp, crisp backlighting and a 16-level, high-resolution gray-scale screen that rotates on command. Which means you can always see your work in the best orientation—horizontal or vertical, even upside down. And in the best light. Bright. Or dim.

The MessagePad 2000 gives you more flexibility, thanks to its two PC slots (other handhelds have only one slot). So, for example, you can dedicate one to a wired or wireless modem and use the other for additional memory.

How much can you do in three to six weeks? That's how long a set of AA batteries lasts under normal usage. Note: normal usage here means a lot. Like having backlighting on, using the modem, crunching numbers, writing e-mail, drawing, doodling, whatever.

Built-in software lets you connect directly to a variety of serial, IrDA and LocalTalk printers—unlike most Windows® CE devices, which have to be hooked up to a PC in order to print.

There's fast. And then there's fast. The MessagePad 2000 comes with a screaming 160 MHz RISC processor, which offers up to five times the performance of the 20-40 MHz processors you get with other handheld devices.

The usable area of the MessagePad 2000 screen is up to 56% larger than what you'll find on most Windows CE products. So, instead of having to decipher small sections at a time, you can read the entire width of a fax or Web page.

A built-in microphone and speaker let you record and play back voice dictation. And the MessagePad 2000 is the only handheld computer that lets you record and take notes simultaneously.

The MessagePad 2000 works easily with desktop computers. So you can create documents on the MessagePad 2000, then transfer them to and from Microsoft® Excel or Word on any Windows or Mac® OS-based system. Or you can keep your calendar and address book current by synchronizing them with desktop programs like Microsoft Schedule+ 7.0 or Claris Organizer® 2.0. And it's easy: with Auto Dock, the MessagePad 2000 makes these transfers automatically.

Unlike Windows CE-based devices, MessagePad 2000 is the only handheld computer that lets you exchange data with both Windows and Mac OS-based computers.

The MessagePad 2000 handheld computer offers a real detachable keyboard (not a tiny, finger-rumpling version). So you can quickly and easily type e-mail business letters, project reports. Only your superb writing style—not your aching fingers—will determine the length of your documents.

Of all the handheld computers out there, only one makes it truly easy to be productive on the road. Introducing the MessagePad® 2000. Rather than just letting you view data, the MessagePad 2000 lets you carry out sophisticated tasks with the greatest of ease. For example: you can now write a full-length proposal, insert information downloaded from the Web—even include pricing from your company's Intranet—and then fax or e-mail it to a client. Try that with an ordinary handheld computer. The MessagePad 2000 has more power, more storage, more flexibility. All contained within the most innovative design, optimized for usefulness. Of course, there's only one real way to understand how incredible the new MessagePad 2000 is: try it yourself. For the name of a dealer near you, or to get more information, call 800-909-0260. Or visit us at www.newton.apple.com/useit.



PROCESSORS

AMD's K6 Arrives

Look out, Pentium Pro: You now have competition! The **AMD-K6/PR-233**—an x86 processor that runs at 233 MHz and supports MMX extensions—is \$56 cheaper per part (in 1,000-unit quantities) than Intel's sixth-generation CPU, yet it offers comparable performance. This chip and its two siblings—the **K6/PR-166** and the **K6/PR-200**—are just now reaching the market, but PC Labs has tested a K6 reference system specially supplied by AMD.

INSIDE THE CHIP

Manufactured on a 0.35-micron five-layer-metal process, the K6 die is almost 20 percent smaller than the Pentium Pro's die (162mm² versus 196mm²), yet it contains 3.3 million more transistors (8.8 million versus 5.5 million). Most of these additional transistors reside in the chip's primary cache, which (at 64K) is larger than that of any other x86 processor.

Using AMD's RISC86 super-scaler microarchitecture, the chip converts each x86 instruction into a series of simpler operations that can then be processed using typical RISC principles (including out-of-order execution, register

renaming, branch prediction, data forwarding, and speculative execution). AMD also has support for Intel's MMX technology.

Despite its sixth-generation internal architecture, the K6 does not use sixth-generation packaging: Its pinout matches that of a classic Pentium. As Intel readies its Pentium II processor and the so-called Slot 1 architecture, AMD is resting its hopes on the venerable Socket 7.

PC manufacturers can reduce costs thanks to the use of extant chip sets and motherboards, coupled with the processor's comparatively low costs. Although a 200-MHz Pentium Pro chip with 256K of on-board secondary cache sells for \$525 (in lots of 1,000), AMD has priced the 233-MHz K6 at \$469 in quantity. Even if the cost of an L2 cache (roughly \$20) is taken into consideration, the K6 still provides more performance per dollar.

INSIDE THE BOX

Unfortunately, the K6 reference system that we received from AMD is not conducive to compar-

isons with today's mainstream business PCs. The company has stacked the deck by including 1MB of L2 cache and a DTP Ultra Wide SCSI controller with 32MB of EDO RAM cache.

The system also came to us with a Matrox Millennium graphics card (4MB of WRAM), a Seagate Cheetah 10,000-rpm Ultra Wide



SCSI hard disk, and 64MB of SDRAM. During testing, though, we used only 32MB of system memory—as we did with machines in our first MMX Pentium review ("MMX Extends the Desktop," February 4, 1997) and our most recent Pentium Pro roundup ("Corporate Voices," December 3, 1996).

PERFORMANCE

Under Windows 95, the machine significantly outperformed the 12 systems in our MMX Pentium roundup. Its ZD Business Winstone 97 score—which represents overall system performance—was 27 percent higher than that of the average MMX Pentium PC and 16 percent higher than that of the two leading machines: the Digital Celebris FX 5200M and the Quantex QP5/200 SM-3. Though both these systems lacked caching disk controllers and contained only 512K of L2 cache apiece, they both used a Millennium graphics card with 4MB of WRAM. The Quantex was equipped with an Ultra SCSI hard disk, while the Celebris used a slower Quantum Fireball Fast ATA-2 drive.

The K6 was just as proficient on

our CPUmark₃₂ test, which measures the speed of a machine's processor subsystem. Under Windows 95, its score was 42 percent greater than the average MMX Pentium score and 32 percent greater than the highest MMX Pentium result.

A comparison between the K6 reference system and the 40 machines in our last Pentium Pro roundup is not quite as conclusive. Under Windows NT, the K6's Winstone score of 66 was unmatched, but its CPUmark₃₂ result was merely average.

With a score of 61, the Zenon Optima Pro Server was that roundup's leading Pentium Pro performer. It included 256K of on-board L2 cache, a 16MB CMD caching disk controller, a Fast/Wide SCSI-2 hard disk, and an ATI 3D Xpression Pro Turbo PC2TV graphics card.

THE BOTTOM LINE

Based on our testing of this K6 reference system, we would conclude that the performance of a 233-MHz K6 is essentially on par with that of the 200-MHz Pentium Pro. Its Winstone score is higher than the average Pentium Pro's score, but these scores are greatly affected by the K6 reference machine's disk subsystem, which was much beefier than any of the Pentium Pro systems we tested.

AMD is naming each version of its chip to reflect its performance (based on AMD's in-house testing) relative to the Pentium Pro; in other words, the K6/PR-200 compared favorably to the Pentium Pro/200. Though companies such as Cybermax and Direct-Wave will be offering K6 systems this spring, none of the leading PC manufacturers have agreed to use the chip as of press time.

By offering Pentium Pro-level performance, AMD hopes to control 20 to 30 percent of the single-user PC market. But the path to such a goal is beset by two major obstacles: The forthcoming Pentium II and the continuing reluctance of leading PC vendors to use non-Intel chips.—Cade Metz

PERFORMANCE TESTS

AMD's K6 Reference System

The K6 reference system's ZD Business Winstone 97 and CPUmark₃₂ scores showed that the K6 outperformed the MMX Pentium systems from our February 4, 1997, roundup. Compared with systems from our December 3, 1996, Pentium Pro roundup, though, the results were mixed.

	ZD Business Winstone 97 Score	ZD CPUmark ₃₂ Score
HIGHER SCORES REPRESENT BETTER PERFORMANCE.		
UNDER WINDOWS 95		
K6 reference system (233 MHz, 1MB of off-board secondary cache, 32MB hard disk cache)	52	561
Average MMX Pentium/200, PC Magazine, 2/4/97 (either 256K or 512K of off-board L2 cache)	41	398
UNDER WINDOWS NT		
K6 reference system (233 MHz, 1MB of off-board secondary cache, 32MB hard disk cache)	66	545
Average Pentium Pro/200, PC Magazine, 12/3/96 (256K of onboard L2 cache)	54	551

EVEN BEFORE THE MMX™ PC MAGAZINE DECLARED



Featured Computer Artist: Wendy Grossman

NOW WITH MMX™ TECHNOLOGY. Ever since the news came out about the new Intel® Pentium® processor with MMX™ technology, savvy computer folk have been racing to get hold of it. After all, it's the best and fastest Pentium chip yet. MMX technology works wonders with multimedia, turns video into a life-changing experience, and even delivers richer Internet content. But which computer to buy? Well...ours. At least that's what *PC Magazine* thinks. In their review of twelve 200MHz systems, the Dell Dimension XPS M200s just won an Editor's Choice award for best business PC, and was named a price/performance leader. And in *PC Computing's* survey, the XPS – which they called "a multimedia powerhouse outfitted for business" – was judged the top performer (see graph). What can this mean? Probably just that in MMX technology, as in everything else, the race goes to the swift.



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PC Magazine Editors' Choice Award
Dell Dimension XPS M200s
2/4/97

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Trends Software

ELECTRONIC FORMS

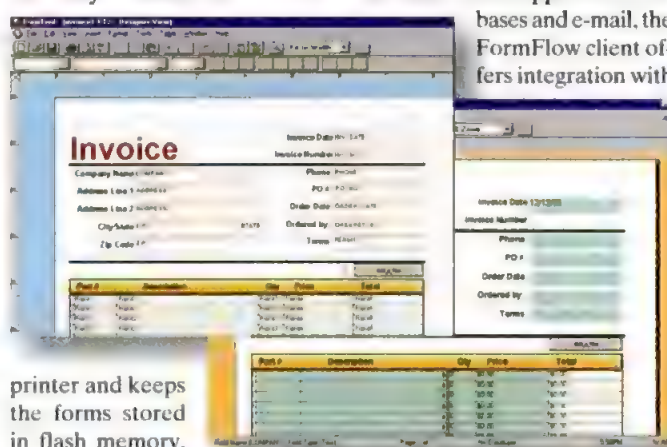
Simply Fill In the Blanks

Whether you're creating an electronic form or filling one out, there's a software package that helps you complete the task.

Caere Corp.'s \$900 **OmniForm Internet Publisher 2.0** (800-654-1187, www.caere.com) makes it easy to publish forms on the Internet. OmniForm lets Web developers convert existing paper forms into HTML, or create new HTML or .PDF forms from scratch; a third format, Caere's text-based Open Forms Markup Language (OFML) for electronic forms, accurately reproduces the layout of forms and allows developers to add over 32 calculations. OmniForm facilitates the submission of forms data through connectivity to existing databases. A free Web browser plug-in for viewing and filling out OFML forms is available from Caere's Web site.

Ganson Engineering's \$599 **Forms-On-Demand** (800-434-9011, www.ganson.com), a multiplatform hardware-software solution, works with any PCL- or Hewlett-Packard-compatible laser printer and with forms created using any Windows software. The system includes the Ganson Forms Manager for

Windows, which lets you download forms to the Forms-On-Demand Processor. The Processor stays connected to the



FORM MAKER: Two stages of a form in the process of being designed in IMSI's FormTool 97.

printer and keeps the forms stored in flash memory, so that they can be edited using

Forms Manager. The Processor then overlays the design of the invoice with the data from your database file to produce a completed form.

At the enterprise-wide level, JetForm Corp. offers **FormFlow 2.1** (800-538-3676, www.jetform.com). Pricing starts at \$129 per user; FormFlow Starter (\$995) includes tools to help developers design customized forms, applications, and routing paths easily.

FormFlow forms can be connected to multiple databases, and data can be encrypted. Forms can include links to outside applications—via OLE 2.0—and routing and tracking automation for forms-based work flow. In addition to new form-building features and wider support for databases and e-mail, the FormFlow client offers integration with

FilePower and Watermark Enterprise Edition, TELEform lets you scan in forms so that the software can interpret the data and send it to the database before routing the scanned image to the document-management program. A \$4,995 companion product, the **TELEform Internet Solution**, automates the collection, creation, distribution, and viewing of data from HTML, electronic, and paper-based forms. Internet Solution automatically converts existing forms and TELEform documents into HTML-based forms. Internet Solution submits completed forms directly to the TELEform Internet Server, where they are converted into the appropriate database format and filed.

Rivalling Caere's and JetForm's packages in functionality is IMSI's \$100 (street price) **FormTool 97** (800-833-8082, www.imsisoft.com). FormTool's Enhancements include a table tool for easily setting up grid matrices on forms; the ability to draw a group of dependent or independent check boxes to simplify survey forms; a signature block for electronic approvals; form routing for review and approval purposes; support for e-mail distribution; relational modeling for linking forms with relational databases; and bar and postal codes.—Melissa J. Perenson

HOME IMPROVEMENT

Building a Cyberdeck

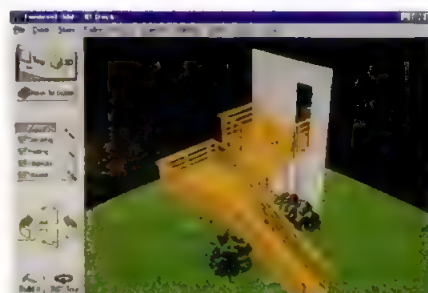
Nowadays, if you want to tear down a wall or build a deck, you no longer need to rely on those Time-Life books advertised on TV. These two programs allow you to custom-design your new deck and visualize it in 3-D, without consulting an architect or contractor.

3D Deck, Version 3.0, from Books That Work (800-242-4546, www.btw.com), is the latest version of a best-selling program targeted specifically at homeowners. With the \$50

(street) 3D Deck, you can design your deck to both suit your aesthetic preferences and meet legal requirements, and the program tells you what you need to get your project off the ground. You can add details—animals, plants, and furniture—and such accessories as fancy lights and guardrails to the image you're putting together, a design flexibility that 3D Deck shares with its sister programs, 3D Kitchen, 3D Landscape, Virtual Home & Garden Suite, and Visual

Home. The latest version of Virtual Home also features Internet integration so you can download additional design details.

Softdesk's \$50 (street price) **Planix Deck 3D** (800-231-8574, www.softdesk.com) places its focus on the details of construction, providing multiple, adjustable views of such minutiae as the space between floor planks. The realistic images generated by Planix fit together seamlessly when merged with digitized photos using an image



DO-IT-YOURSELF: Books That Work's 3D Deck, Version 3.0, helps homeowners design a deck.

editor. And a wizard walks you through the process of designing a deck. The software also comes with the best-selling how-to book *Sunset Decks*, from Sunset Publishing.—Josh Levy

Trends Peripherals

MASS STORAGE

Backup by the Gig

In offices where a nightly data backup is standard operating procedure, DAT (digital audio tape) drives are a popular choice. Not only are they easy to use, but the media is also inexpensive (1.7 cents per MB). The latest iteration of the Digital Data Storage (DDS) industry standard, DDS-3, can store up to 24GB of data—the equivalent of over 40 CD-ROMs—on one cartridge. DDS-3 is also fast, achieving a data transfer rate of more than 2 MBps (megabytes per second) or 7.2GB per hour by using read-after-write technology. This

method allows the drive to validate the written data on the fly, eliminating a second validation pass. The first DDS-3 products out the gate are from Hewlett-Packard (800-826-4111, www.hp.com), Sony (800-352-7669, www.sony.com/storagebysony), and Seagate Technology (800-732-4283, www.seagate.com).

HP's **SureStore DAT24** (\$1,947 internal; \$2,101 external) features Tape Alert, HP's new self-diagnostic tool. Built into the

firmware, Tape Alert works with the backup software (Seagate Backup Exec and Cheyenne ARCserve for Windows NT and NetWare come with the drive) to let network administrators at both

and comes with four 24GB tapes. (The same drive bundled with Cheyenne ARCserve for Windows NT and NetWare lists for \$2,369.) The release of an external version, the **SDT-S9000** (\$1,599; \$2,399 with the same set of software), is expected

by early summer. The Sony drives' claim to fame is the 24-Hour Swap Program, which pledges to replace a failed drive in one day.

Seagate's DDS-3 internal offering, the **Scorpion 24** (\$1,973), should be shipping by the end of May. The drive has a 2.2-MBps transfer rate and is expected to come with Seagate's Backup Exec software for Windows NT or NetWare.—*Toni Kistner*



STORAGE PLUS: HP SureStore drives (upper left) and Seagate's Scorpion 24.

local and remote sites identify specific errors and potential problems. The drive uses 125M DDS-3 media; a five-tape pack costs \$200.

Sony's internal DDS-3 drive, the **SDT-9000** (\$1,499), has a data-transfer rate of 2.4 MBps

UPSs

Absolute Power

A steady flow of 120 volts of power at 60 Hz is critical for operating your PC. If the power surges or spikes, especially during summertime brownouts, hard-to-trace problems may result. An uninterruptible power supply (UPS) acts as a buffer between a workstation or server and the AC power supply, conditioning the flow of electricity. In the event of a power loss, the UPS automatically saves your open files and initiates a shutdown.

Personal UPSs can be had for as little as \$100. But to protect multiple servers, UPS solutions can cost thousands of dollars, depending on the capacity—measured in volt-amperes (VA)—you need.

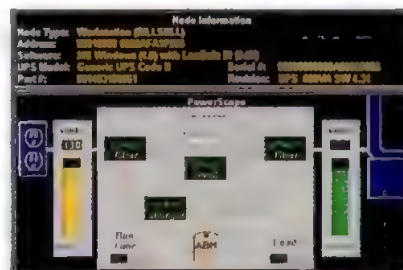
Although a traditional UPS battery using the trickle-charge method lasts anywhere from 2.5 to 3 years, Deltec (800-854-2658, www.deltecpower.com) aims to extend battery life through its Advanced Battery Management (ABM) system, which extends battery life to over 5 years. This technology

utilizes a three-step charging process—fast, floating, and rest—that eliminates the premature failure associated with trickle charging. As a Deltec battery nears the end of its life, a service alarm goes off about 60 days in advance, giving you plenty of time to do a hot swap with a fresh battery.

Deltec's **PowerRite Pro II Series** (starting at \$699 per work-

station) range from 1000 to 3000 VA and come in both tabletop and rackmount models. The bundled management software, LanSafe III (for LANs) and FailSafe III (for workstations), saves and closes files when the power dies. The software also provides remote network monitoring and allows administrators to establish a sequential shutdown of all networked devices.

If you need to protect a data center in the 8- to 16-KVA range, APC Corp.'s **Symmetra**



SOFTWARE ASSIST: Deltec's LanSafe III software.

Power Array modularity (800-877-4080, www.apcc.com) provides scalability for expanding networks and redundancy for an extra layer of protection. With prices starting at \$9,999, the Power Array consists of multiple, hot-swappable 4-KVA Power Modules and Battery Modules that let you expand, reconfigure, or redistribute the UPS load as needed. The design includes four SmartSlots, which the administrator can fill with power management accessories to monitor the UPS via network SNMP, Internet, or modem connections. APC's power management software, PowerChute Plus 5.0, provides remote UPS management and the ability to schedule recurring self-tests and shutdowns for specific dates.—*TK*

MULTIFUNCTION PRINTERS

All You'll Ever Need

If space and money are tight in your office, consider the OfficeJet 570 (\$500 street) from Hewlett-Packard (800-752-0900, www.hp.com). This all-in-one device combines a 300 dots-per-inch color inkjet print engine (600-dpi monochrome) with a fax, copier, and 8-bit monochrome page-fed scanner. Unlike earlier OfficeJet models, which could be used independent of your PC, the 570 must be connected to your PC's parallel port in order to work, although you can send faxes without turning on your computer. HP has developed an easy-to-use software utility to interface with the unit and facilitate faxing, scanning, and copying documents.—*TK*



RECAP In our November 5, 1996, review of multifunction printers, the Brother MFC-4550 won the Editors' Choice.



*Suggested retail price. For more information, see us at www.hp.com/go/officejet-pro

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The HP OfficeJet Pro 1150C.

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All for the cost of a designer suit.

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 **HEWLETT
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WEB SITES

Working the Net

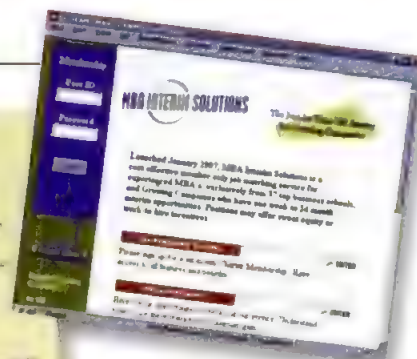
Improvements in online employment services are brightening the prospects of filling and landing a position via the Web.

E-Span (317-469-4534, www.espan.com) recently revamped its site to make it more palatable to job seekers and employers alike. In addition to implementing Oracle database technology for more sophisticated searching and matching capabilities, E-Span has added some new tools for HR professionals.

Employment-ad templates for over 200 disciplines help save time writing notices, and a voluntary personality-assessment test can give employers a better idea of the

person behind the application. There's also a service where résumés are matched with a company's candidate profile and then e-mailed to the hiring manager. E-Span has made its databases more transparent to job seekers by displaying job-search results, interview information, and salary statistics on a single page.

MBA Interim Solutions (201-258-0432, www.mbainterimsolutions.com) has done much of the legwork for corporations by culling its job hunters from an MBAIS-chosen list of 37 top business schools in the U.S. and Europe.



JOBS.COM: Using the Web for recruiting.

MBAIS's most comprehensive annual rate, which includes unlimited placements, is generally less than the fee paid for just one hire by an executive recruiter. Companies can take advantage of a free six-month trial membership.

Those of you who are in the hunt for a new job will likely benefit from the latest release of Indi-

vidual Software's **ResumeMaker Deluxe** multimedia CD-ROM (\$40 street price; 510-734-6767, www.individualsoftware.com). ResumeMaker now helps you post your résumé to the databases of major online résumé banks. It also assists in searching the listings of online employment services by location, job title, and salary.—Regina Kwon

MARKETING TOOLS

A Word from Our Sponsor

The Web can help you learn more about your customers. Two companies are offering services that allow you to capitalize on the Web to better market your products.

Narrowline (415-975-5300, www.narrowline.com) has developed **Brought To You By**, an interactive marketplace for media buyers to find the Web sites that match their target audiences. Content publishers provide explanations of their site as both whole and component parts. They also list their available ad inventory. This information then goes into Brought To You By's searchable database.

Media buyers can visit the site and identify their target audiences and goals in placing a banner ad. The site will then generate a list of content publishers who meet their needs, and it will even serve as a channel for the sale of the ads. Buyers can track their ad performance in real time, in both impressions and click-through rates. They can change their ads at any time based on response. Narrowline takes a small transaction fee as a percentage of sales when ad

space is bought or sold.

MarkWatch 2.0, from Datalytics (937-226-7700, www.markwatch.com), is an electronic clipping service that lets a company learn how netizens refer to its product on the Web, in Usenet newsgroups, in chat rooms, and on mailing lists.

Useful for market research, brand-image management, and common-law trademark searches, this service employs a variety of tracking facilities to generate its reports for marketers. MarkWatch uses the AltaVista and Lycos search engines to acquire raw material. It then performs additional filtering and validation to derive sites of interest for clients. MarkWatch also searches daily on 400 news sites whose content often eludes search engines because of normal turnover.

MarkWatch generates a report at specified time intervals and in a variety of forms—via the Web, regular mail, e-mail, or fax.

MarkWatch offers a number of pricing options, but an annual subscription for a single information profile is \$895.—David Lidsky

MULTIMEDIA

Creative Programming

So what can the Internet give you that TV or radio—or a newspaper, for that matter—can't? Creative Technology believes part of the answer lies in community, a driving idea behind a new multimedia application, **Creative Inspire** (408-428-6600, www.soundblaster.com).



INTERTAIN US: Be the star of your own Creative Inspire channel.

Creative envisions Inspire as a venue where musicians and gamers can interact and learn from each other. Both well-known and aspiring artists and game developers can use Inspire's program-channel metaphor to broadcast their live or recorded content.

Once installed, Inspire—which is available as a free download from Creative's Web site—will take you to the Internet via the Inspire interface, which mixes TV, VCR, and radio "buttons" in a frames-based view. Currently, Inspire uses Microsoft Internet Explorer underneath its own interface. The company says it is working to support Netscape Navigator.

All the plug-ins you might need are built in and updated automatically in the background. Inspire features OnLive! Technologies' multipoint audio chat solution so that users can talk over the Internet in real time.

Creative's partnerships with such companies as Progressive Networks, Total Entertainment Network, and Wave Systems will focus on furthering the integration of streaming audio and video, gaming, and commerce over the Internet.—RK



13.3" DISPLAY

200MHz Light Speed

TravelPro 2020CX



13.3" DISPLAY	1024x768 @ 65,000 Colors
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Zoom Video Support	On PC Card Type III Slot
32MB RAM	EDO RAM Expandable to 80MB
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The TravelPro 2020 is a multimedia dream machine; delivering crisp 1024x768 graphics that produce the most incredible visuals ever seen in a 6.5 lb portable package. The large 13.3" XGA-TFT display has as much viewing area as a desktop monitor.

The TravelPro 2020 is powered by the 200MHz Intel Pentium® Processor with MMX™ Technology, and is the fastest & most powerful mobile CPU available, boosting audio, video and image rendering & processing. The system is loaded with standard features like built in wave table audio, video capture system that delivers live video or television right on the notebook display, 10X CD-ROM, and an internal 33.6 fax/modem. Combine all this with an estimated street price of only \$5,295.00, and you'll see why compared to the TravelPro 2020CX, the rest of the competition just doesn't measure up.



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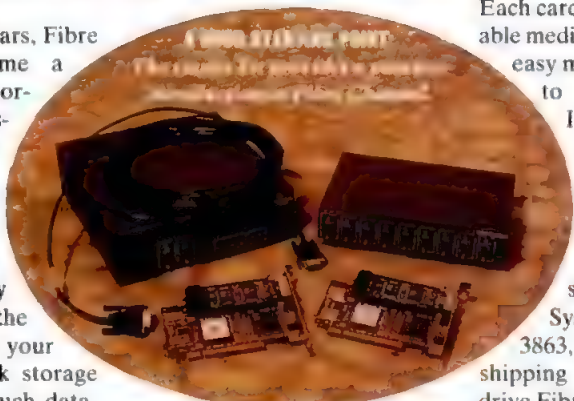
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Trends Networking

ULTRAFAST NETWORKING

Fibre Is Good for You

Over the past few years, Fibre Channel has become a major force in the storage arena. With transfer rates of up to 200 MBps over a full duplex connection (five times as fast as Ultra SCSI), Fibre Channel connectivity can help eliminate the bottlenecks between your server and your disk storage that are caused by such data-intensive applications as data mining, warehousing, and on-line transaction processing. If you're considering putting Fibre Channel on your network, there



are some new options you can choose from.

If you want to purchase individual components, Jaycor

Networks (619-535-3121, www.jaycor.com) recently introduced its **FibreStar Fibre Channel** adapter (starting at \$1,995 for a PCI bus; \$3,530 for an S-bus). Each card comes with a removable media interface module for easy migration from copper to fiber-optic cabling. In addition, the card supports drivers for Microsoft Windows NT 3.51 and 4.0, and Solaris 2.x.

On the mass-storage front, Box Hill Systems Corp. (800-727-3863, www.boxhill.com) is shipping **Fibre Box**, an eight-drive Fibre Channel enclosure. **Fibre Box** (starting at \$36,000 for 36GB of storage) provides a maximum of 72GB of storage, but you can daisy-chain as many as 125 drives for a total of

1,125GB. Each drive is hot-swappable and comes with dual ports, allowing it to sit on two Fibre Channel arbitrated loops simultaneously. The drives' exclusive-or (XOR) logic provides the enclosure with level 5 RAID functionality without the need for external controllers.

If you're looking for a one-stop-shopping package, you can opt for the integrated solution from Bell Microproducts (800-697-2355, www.bellmicro.com). The \$9,995 **Starter Kit** contains Gadzook's Fibre Channel Arbitrated Loop Active Hub, Seagate Technology's 9GB Barracuda Fibre Channel drive, two of Interphase Corp.'s Fibre Channel host adapters, and three 3-meter copper cable assemblies from W.L. Gore and Associates. —Robert Daly

ULTRAFAST NETWORKING

The Bandwidth Cometh

With the IEEE 802.3z Gigabit Ethernet standard reaching the working group ballot stage by this summer, you can expect to see Gigabit Ethernet products finally reaching the market in the second half of this year. Alteon Networks (888-258-3661, www.alteon.com) and Packet Engines (509-922-9190, www.packetengines.com), however, have gotten a head-start and are already shipping end-to-end Gigabit Ethernet solutions. (upgrades will be made available as needed).

The Alteon Gigabit family includes the **Aceswitch 110** (pricing starts at \$8,995) and the **AceNIC** (pricing starts at \$1,495 for PCI and \$1,895 for S-Bus). The Aceswitch is a manageable rack-mountable unit that comes with eight half- or full-duplex 10/100 Ethernet ports, a full-duplex Gigabit Ethernet port, and a PCI option port that can be configured as a second Gigabit Ethernet port.

On the adapter side, Alteon's **AceNIC** comes in both PCI

and S-Bus architecture, with driver support for AIX, Microsoft Windows NT 4.0, and Solaris. The adapter's Tigon ASIC integrates 10/100/1,000-Mbps Ethernet MACs, dual DMA channels, an I/O bus interface, and an embedded 32-bit RISC engine.

Packet Engines recently introduced its **FDR12 Model 1000** (\$17,995), a full duplex Gigabit Ethernet repeater. It comes with a total of 14 ports: 12 ports support 1000Base-SX (short-wave laser); one port has increased buffering that can cascade to other Gigabit repeaters; and the final port can be configured for a legacy connection at either 10- or 100-Mbps Ethernet. The FDR12 can be managed via the traditional serial port, over SNMP, via a telnet session, or through a Web browser. The repeater generates an HTML page with information from various SNMP MIBs.

The **G-NIC** (price \$1,295), Packet Engines' Gigabit Ethernet adapter, supports 1000Base-SX



Ethernet and comes with a PCI bus for simple plug-and-play installation. Driver support consists of Windows 95 and Windows NT

4.0, NetWare 3.12/4.2, and Unix. As with the FDR12, it can support full-duplex connections for 2-Gbps throughput.—RD

NETWORK-ANALYSIS TOOLS

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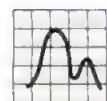
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First Looks



Service for Two

Today's dual-Pentium Pro servers offer the exciting features of high-end servers.—Carol Venezia

The days when only the high-end of a vendor's server line offered the redundancy and scalability features required of mission-critical environments are history. Call it the trickle-down theory of servers, but leading-edge features eventually make their way into more mainstream—and less expensive—products.

In this mini-roundup of dual-Pentium Pro servers, we look at hardware from four of the leading vendors in this market: ALR's \$14,225 Revolution MP Pro; Dell's \$18,696 PowerEdge 4100; Hewlett-Packard's \$14,690 NetServer LH Pro; and IBM's \$15,127 PC Server 330. We also catch a glimpse of

Compaq Computer's exciting new offering, the ProLiant 6000 (see the sidebar "Compaq's Four-Way Street").

QUAD-CPU

This roundup also gives us the opportunity to introduce the ZD ServerBench 4.0 test suite, which stresses all the vital subsystems that go into making a good server. Each machine was set up with as close to the same configuration as we could get: a pair of Pentium Pro CPUs, 128MB of RAM, about 9GB of data storage, and Microsoft Windows NT 4.0 Server. This way, we could accurately gauge how each system responds to network traffic on a

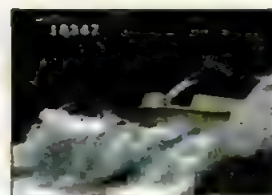
real-world 60-client LAN.

After the dust had cleared, we were pleasantly surprised by the robustness of the hardware presented here. In our last roundup of departmental-level servers ("Server Power," March 26, 1996), the systems were based on Pentium CPUs and were all single-processor machines priced between \$16,000 and \$23,000 (although a handful could be upgraded with a second CPU). Since then, Intel's Pentium Pro processor has become the gold standard for server CPUs. This has reduced prices to the point where a dual-Pentium Pro system costs less today than a similarly configured single-Pentium server cost just one year ago. In fact, many major vendors have either abandoned Pentium servers altogether or relegated them to entry-level status.

INSIDE



POCKET POWER: With the Zaurus ZR-3500X, Sharp is ready for hand-to-hand combat. See page 70.



SHOWTIME: Data Translation lets you capture video affordably with Broadway 2.0. For the full review, see page 66.



TACTFUL TASKING: Scitor's Project Scheduler 7 tackles the complexities of project management. See page 76.

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First Looks Online

From May 5 to 9, go online to discuss the new Creative Labs PC-DVD.

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First Looks



The ALR Revolution is the bargain of the group.

ALR Revolution MP Pro.

List price: With dual 200-MHz Pentium Pro CPUs, 512K external cache per CPU, 128MB RAM, four 2GB hard disk drives, RAID adapter, Microsoft Windows NT 4.0 Server, \$14,225

Advanced Logic Research, Irvine, CA; 714-581-6770; fax, 714-581-9240

www.alr.com

Circle 413 on reader service card.

It's not just the CPU that's grown up, either. Today, you will see redundant and hot-swappable power supplies, an assortment of RAID storage options, dual integrated SCSI channels for disk duplexing, a multitude of hot-swap drive enclosures, and even sophisticated system management programs. Features vary from product to product, but two trends stood out during testing. First, while the Revolution used up a precious PCI slot for a graphics adapter, the other three had a variety of accelerator chips integrated on the motherboard. Second, the majority of systems packed their oversized boxes with a pair of 200-MHz Pentium Pro CPUs

and 512K of external cache. The NetServer goes its own way by using the less expensive 256K external cache Pentium Pro processors, and its performance lagged behind the others.

When you take all the variations into account, one truth emerges: You get more for your server dollar now than ever before.

Of this quartet of power servers, we were most impressed with the Dell PowerEdge 4100, which surpassed the others in terms of features and performance. It did so at roughly the same cost per TPS at full client load, which is the closest thing we've found to a bottom-line measurement of server value.

The system marks a coming of age for Dell, which over the past year has moved from

being the "other" category (in terms of PC server shipments) to becoming the number-four vendor. Even though other servers present a sampling of redundant and fault-tolerant components here and there, the PowerEdge puts it all together.

Determining which of these four servers is right for your network depends on the particulars of your situation. Rest assured, though: There's a server here that's up to the task.

Advanced Logic Research

Revolution MP Pro

AL R covers most of the bases with its Revolution MP Pro, offering memory expansion up to 1GB, a decent amount of hot-swappable storage, and dual-redundant 365-watt power supplies. At \$14,225, the Revolution is a no-frills server that gets the job done.

The Revolution's tall tower case houses a floppy disk drive and a CD-ROM drive up front. It also features four 5.25-inch drive bays behind a lockable front panel. During our evaluation, we found that the panel snaps off too easily, affording

little actual security.

Outfitted with two ALR Hot-Swap Cages (both can hold three hard disks), the Revolution came with five bays filled. The disks don't have individual drive-indicator lights or activity lights. There's one light for the array, so you can't see at a glance if one isn't working.

Once unlocked, the hot-swappable disks are easy to remove. During testing, we wondered why ALR used a hot-swap device bay for the operating system hard disk, because there were two standard internal 5.25-inch drive bays available. On the upside, the Hot Swap Cages come with channel number and disk ID number labels, which correspond to the disk configuration information in the system's SCSI BIOS for easy identification.

Getting inside the Revolution is easy: Just remove three thumbscrews and the side panel comes right off. Unfortunately, we found that the screws, which aren't attached to the panel, are easy to lose. On the flip side of the panel, you will find memory map-

SUMMARY OF FEATURES

Dual-Pentium Pro Servers: Side by Side



Products listed in alphabetical order	ALR Revolution MP Pro	Dell PowerEdge 4100	HP NetServer LH Pro	IBM PC Server 330
Price of tested configuration	\$14,225 (list)	\$18,696 (direct)	\$14,690 (street)	\$15,127 (list)
Processors	Pentium Pro/200	Pentium Pro/200	Pentium Pro/200	Pentium Pro/200
External cache	512K	512K	256K	512K
Maximum memory and module type	1GB, SIMM	1GB, DIMM	1GB, DIMM	1GB, DIMM
Chip set	Intel 82440FX	Intel 82440FX	Intel 82440FX	Intel 82440FX
Network interface card	Adaptec Coagent EM 100	Intel EtherExpress Pro 100TX PCI LAN Adapter	HP DeskDirect 10 100TX PCI Lan	IBM 100 10 PCI Ethernet
Hard disk	Seagate Barracuda 4LP ST32171WC	Seagate Barracuda 2LP ST32550WC	Seagate ST32151	IBM DFHS S2W
RAID controller	ALR ADAC RAID Adapter 418	Dell PowerEdge Expandable RAID Controller	HP Net RAID	Mylex DAC960PD
Expansion-bus slots	1 EISA, 4 PCI, 3 PCI/EISA	3 EISA, 5 PCI	4 EISA, 4 PCI, 1 EISA/PCI	4 EISA, 1 PCI, 4 PCI/EISA
Maximum number of power supplies	2	2	2	1
Server management software	InforManager	Intel LAN Desk 2.5	HP NetServer Navigator	Tivoli TIME 10 Netfinity

ping instructions for RAM as well as a place to fill in channel, RAID-level, and disk ID numbers for the disk subsystem.

The Revolution's AMI motherboard features a pair of socketed 200-MHz Pentium Pro CPUs with 512K of external cache each. What's most impressive about this board is its expansion potential: With four PCI slots, three EISA/PCI slots, and one EISA slot, you can get more expansion cards into this unit than any of the other servers reviewed in this roundup.

Unfortunately, ALR chose to fill one PCI slot with a graphics board. The remaining slots hold four Adaptec Co-gent EM110 TX Fast Ethernet adapters (which support 10Base-T, 10Base2, or coaxial cabling) and a single-channel ALR ADAC FlexRAID Ultra Wide disk controller with 8MB of ECC RAM, which is powered by a 33-MHz Intel i960 CPU. Our test system had four 2GB Seagate Barracuda 4LP Ultra Wide hard disks in a RAID 0 array.

On the whole, we found the Revolution easy to service. All of its cables were neatly tied off. Also, there's no card swapping for system upgrades, because the CPUs and memory slots are located directly on the motherboard. Unfortunately, its CMOS back-up battery is soldered to the board and will likely cause service headaches when it dies.

On our ZD ServerBench tests at both single- and dual-CPU configurations, the Revolution's peak dual-CPU throughput left it on the heels of the Dell PowerEdge 4100, regardless of client load.

At \$14,225, the ALR Revolution MP Pro came in with the lowest cost-per-TPS of the group in this roundup. So if your top priority is a low price, then the Revolution is the server for you.

Editors' Choice

• Dell PowerEdge 4100



When buying a server, balance is everything.

We found one machine in this group that met the challenge in terms of price, performance, features, and

server-management support: The Dell PowerEdge 4100, which earns our Editors' Choice award.

The PowerEdge might be slightly more expensive than the other servers here, but it provides excellent value. Not only was the PowerEdge the leading performer of the group, it also provided an extremely important feature



Dell Computer Corp.

PowerEdge 4100

Think it's impossible to buy a serious server from a mail-order vendor? Well, think again. Dell's \$18,696 PowerEdge 4100 offers class-leading hardware features, chart-topping performance, and a flexible management solution. It's more expensive than the others, but

you get what you pay for.

The PowerEdge's wide-tower case houses a floppy disk drive, a CD-ROM drive, and two empty 5.25-inch drive bays up front. In addition, it comes with six hot-swappable drive bays. Each hot-swap enclosure has individual drive-indicator lights for activity, online status, and fault status, so you can tell if one isn't working. There is

that none of the others provided: hot-swappable, redundant power supplies. Add to this an easy-to-use management solution, as well as integrated out-of-band management support, and you have a clear winner.

We also recognize Hewlett-Packard's NetServer LH Pro as a machine worthy of an honorable mention. If class-leading server management tops your list of priorities, the NetServer is an excellent choice. HP's NetServer Assistant is a complete, machine-specific solution that can guide even the

uninitiated through setting up and configuring a NetServer from scratch. Another exciting feature first brought to market by the NetServer—and subsequently duplicated by many other vendors—is the integration of dual-SCSI controllers on the motherboard. Now you can duplex your disk subsystem right out of the box.

a single lock to cover all six drives, which we found easy to remove and replace.

To get inside, you first have to slide off the side panel, which is held in place by spring-loaded, nonremovable screws—a definite plus. The system's Intel motherboard integrates two 200-MHz Pentium Pro processors with 512K of external cache each, eight DIMM slots (1GB of RAM maximum), and the system's graphics chip set.

The PowerEdge provides four PCI slots, one shared slot, and two EISA slots. On our test configuration, four slots were used by Intel Ether-



Dell PowerEdge 4100

Direct price: With dual 200-MHz Pentium Pro CPUs, 512K external cache per CPU, 128MB of RAM, four 2GB hard disk drives, RAID adapter, Microsoft Windows NT 4.0 Server, \$18,696.

Dell Computer Corp., Austin, TX;
800-388-0542

www.dell.com.

Circle 414 on reader service card.

First Looks

Express PRO/100TX Fast Ethernet adapters, while the last PCI slot housed the unit's disk controller with 8MB of ECC RAM. This controller was hooked up to the system's four Seagate Barracuda 2LP Fast/Wide SCSI-2 hard disks. Unlike the Revolution, the PowerEdge's OS disk was placed in a standard drive bay, so two hot-swap enclosures are left open.

The machine's advanced RAID controller is powered by a 33-MHz Intel i960 RISC CPU. It also provides two Ultra Wide SCSI channels, two external SCSI connectors, and a NiMH backup battery on the controller. If your storage needs don't require a RAID controller, the PowerEdge has two integrated SCSI adapters: One Adaptec 7880 Ultra Wide channel, which hooks directly to the drive array's SCSI backplane, and one Adaptec 7860 narrow SCSI connector for de-

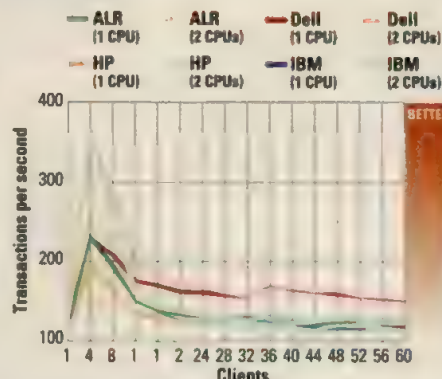
BENCHMARK TESTS

Dual-Pentium Pro Servers



On dual-processor tests, the Dell PowerEdge 4100 led the way, with a score about 25 percent higher than that of the next-best competitor, the ALR Revolution MP Pro, at full client load. The HP NetServer LH Pro trailed the field, as a result of its 256K of external cache for each CPU (versus 512K per CPU for the other units).

We ran the ZD ServerBench 4.0 benchmark tests to measure the performance of these servers in a client/server environment. On ServerBench, client PCs burden each server with transaction requests for different kinds of work. These requests then produce different types of loads on the servers. Each client records how many transactions it completes and how long it takes to complete them. ServerBench uses the client information to produce an overall tps (transactions-per-



second) score. The servers were each equipped with one or two Pentium Pro CPUs, 128MB of RAM, and at least 8GB of data storage and ran Microsoft Windows NT 4.0. The clients ran either Windows 95 or Windows NT.

vices such as CD-ROM or tape backup.

We were also impressed with the PowerEdge's clearly labeled cabling. And despite the fact that other servers sup-

ported failover power supplies, the PowerEdge was the only server to add redundant hot-swappable power supplies. The PowerEdge's two 500-watt power supplies are an impor-

tant feature for keeping the server running 24 hours a day.

On our ZD ServerBench tests, the PowerEdge trailed the pack at up to 8 clients, but it took the lead at loads above

Compaq's Four-Way Street

If you were as impressed as we were with Compaq's ProLiant 5000 quad-processor Pentium Pro server (we gave it an Editors' Choice in a server roundup last fall), stand back: Compaq's ProLiant 6000 will definitely knock your socks off. This new server takes expansion, capacity, availability, and redundancy to new heights.

Compaq took a few moves from Hewlett-Packard's playbook when it came to the design of the ProLiant 6000. At first glance, it bears a striking resemblance to the NetServer LX Pro: It has a wide, low, wheel-mounted enclosure that's easy to get into via a removable top panel, and it provides a huge amount of internal storage via 18 front-accessible, hot-swappable drive bays.

The first features you'll notice are the big handles on the front of the case. Just pop the wheels off the bottom of the enclosure, add the necessary hardware via Compaq's \$1,200 rack-mount kit, and the ProLiant can be added to a standard Compaq 19-inch rack.

Turn the ProLiant 6000 around and you'll see its other big feature: a trio of hot-swappable 765-watt power supplies. These are certainly a welcome addition to the ProLiant family. Remove the top cover of the ProLiant 6000 (which comes complete with spring-loaded, nonremovable screws) and you'll find expansion features galore (such as nine PCI slots on this expansion backplane). If you've ever dropped screws into a server enclosure while



trying to service a machine, you'll appreciate the addition of the nonremovable clips that hold the cards in place. Just pop them to the side and expansion cards come right out. Compaq also adds guide rails to the opposite side of the backplane, so cards align and seat properly.

Another neat new feature of the ProLiant 6000 is its front-mounted LCD panel.

Everything you ever wanted to know about your server's status is there: an event log, a server information log (including server name, asset tag, and installed OS), an administrator and service information log (with the names, phone numbers, and pager numbers of your network administrator and service rep), a system information log (featuring ROM date, amount of memory installed, and type and number of processors installed), as well as an additional final log for any other system information.

A beta ProLiant 6000 with two 200-MHz Pentium Pro CPUs was able to keep up with the top-performing Dell PowerEdge system, but it fell off the pace at high-client load.—CV

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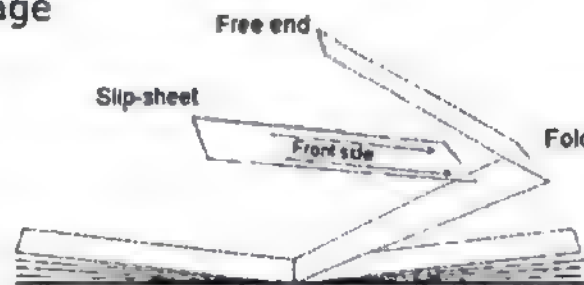
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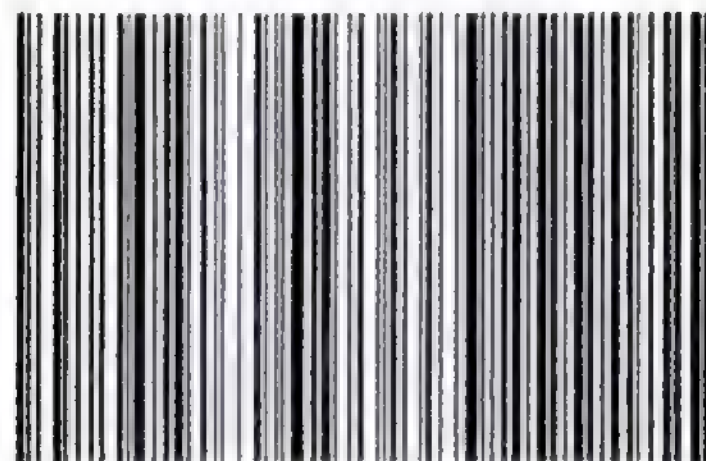
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Foldout slip-sheet



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Folded edge of the page

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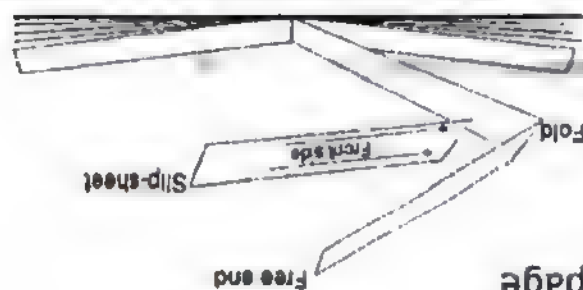
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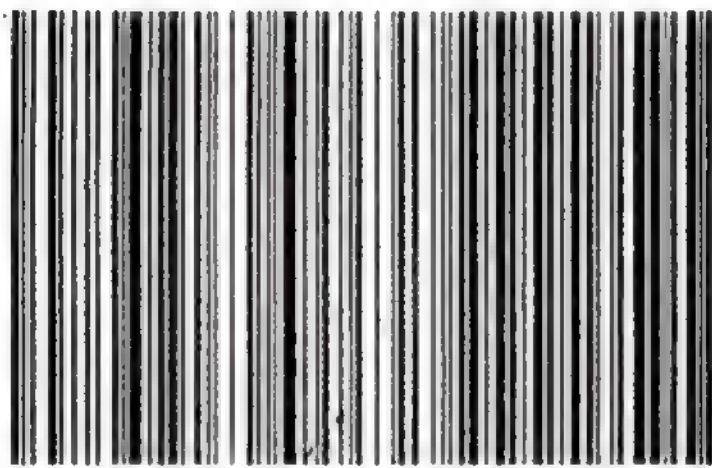
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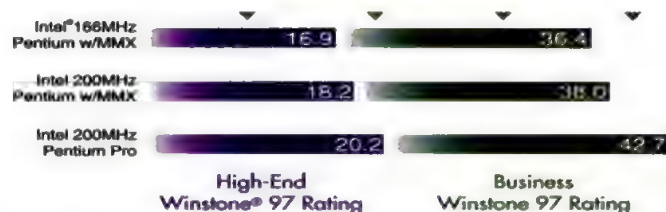
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Performance Graph



Ziff-Davis' Winstone 97 Version 1.0 produced scores of 16.9 and 36.4; 18.2 and 38.0; and 20.2 and 42.7 Winstone Version 1.0 units on its High-End Winstone 97 suite and Business Winstone 97 suite on Gateway 2000, Inc. PCs configured with 166MHz Intel Pentium Processor with MMX technology, 200MHz Intel Pentium Processor with MMX technology, and 200MHz Intel Pentium Pro processor, respectively. All Gateway 2000 PCs tested featured 32MB RAM, 256K RAM cache, 3.8GB hard disk, IDE controller, FAT file system, and no hardware disk cache. Systems include S3 ViRGE/VX graphics adapter; with 4MB VRAM with v1.23m3 driver; 1024x768 with 256 colors; and a refresh rate of 75Hz. Test systems used MS DOS 7.1 and MS Windows 95. All products used in the test were shipping versions available to the general public, and the test and its results were not verified by Ziff Davis.

*MS Office 97, Small Business Edition plus Encarta® 97 includes MS Word 97, Excel 97, Publisher 97, Autograph® Streets, Small Business Financial Manager and Outlook™ 97.

**MMX Technology-Enhanced Software Bundle includes Pod™, Eraser™ - Turn About, The Ultimate Human Body Version 2.0, and The Third Dimension™.



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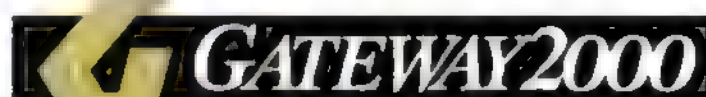
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- MS SideWinder™ 3D Pro Joystick \$59
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First Looks

12 clients. At 60 clients and two CPUs, the PowerEdge's throughput was 25 percent higher than its next-closest competitor, the Revolution.

Dell provides the PowerEdge with exceptional management support with the Server Assistant CD, which contains system utilities, drivers, diagnostics, and documentation. Configuration utilities are also provided for the RAID subsystem. Dell includes Intel's LAN-Desk Server Manager, as well as its Remote Assistant, which monitors temperature, voltage, fan status, integrated SCSI and SCSI backplane management, and other system vital signs. By attaching a modem to the unit's serial port, you can also monitor the server remotely—even when it's down.

From soup to nuts, the Dell

PowerEdge provides a full server meal.

Hewlett-Packard Co.

HP NetServer LH Pro

If best-in-class management support and a rock-solid design is more important to you than barn-burning performance, check out HP's \$14,690 NetServer LH Pro.

The NetServer's gray enclosure wins points in the design category. Its exterior has a floppy disk drive, a CD-ROM drive, and an open 5.25-inch drive bay for another device such as a tape backup. There are also six hot-swappable drive bays; one lock covers all six drives, and each drive has its own indicator lights.

Accessing the NetServer's interior is as easy as loosening a few spring-loaded screws that are attached to the cover.

Once inside, you'll find useful and detailed road maps. One map tells you how to duplex your drive subsystem using the unit's internal controllers. It also explains how you can set up an array using a PCI controller. Additional maps explain the system board, power connections, and the processor board.

The NetServer uses a daughter-card design for its processor and mem-

ory. This way, CPU or RAM upgrades can be performed by replacing or refitting this board. Screws holding this board in aren't removable, so you won't have to worry about dropping any inside the chassis. For expansion, the NetServer offers four PCI slots, four EISA slots, and one shared slot. All slots have guide rails to hold cards in, and a retention bracket holds them all firmly in place.

On our tests, four PCI slots were used by HP DeskDirect 10/100TX Fast Ethernet adapters. The remaining PCI slot held a Net-RAID disk controller with 8MB of ECC RAM; this was hooked to the system's five Seagate Fast/Wide SCSI-2 hard disks. Like Dell, HP had the foresight not to use a hot-swappable drive bay for the disk for the OS.

The Fast/Wide SCSI-2 RAID controller runs on a 33-MHz Intel i960 processor and features three channels, two external SCSI connectors, and an on-board battery backup. The NetRAID Assistant's graphic interface made configuring and checking the drive array a snap. If you've ever spent time using a klunky DOS utility to set up a RAID array (which is the case with most RAID adapters), you'll appreciate NetRAID Assistant. On our tests, the NetServer came with a 256-watt power supply installed. A second redundant power supply option is \$719.

This unit came with Pentium Pro processors containing 256K of external cache (compared with 512K per CPU for the competition), so its performance lagged, especially when tested with two processors. The more expensive NetServer LXE pairs 200-MHz CPUs with 512K of cache.

HP's NetServer LH Pro continues to lead the way with state-of-the-art management software, but it lags in performance.

IBM PC Co.

PC Server 330

IBM's \$15,127 PC Server 330 is much like HP's NetServer LH Pro: What it lacks in performance, it makes up for in solid design and server management.

Like IBM's other server offer-



Solidly built, the NetServer LH Pro never lagged in performance.

IBM PC Server 330

List price: With dual 200-MHz Pentium Pro CPUs, 512K external cache per CPU, 128MB of RAM, five 2GB hard disk drives, RAID adapter, \$15,127.

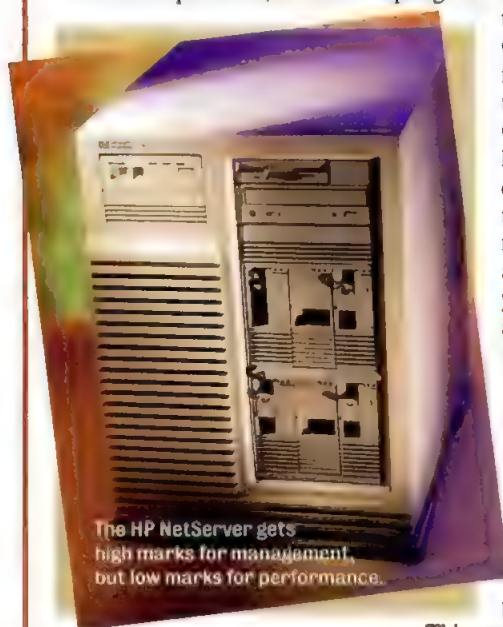
IBM PC Co. Armonk, NY; 800-772-2227

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Circle 416 on reader service card.

ings, the PC Server 330 is built like a truck. The chassis is tall and narrow, but it's made of heavy-gauge steel with side supports, so it won't tip over. Hidden behind the server's lockable and removable front panel are the status LEDs for the system's two 200-MHz Pentium Pro CPUs with 512K external cache. You'll also find hard disk activity, security, and Ethernet transmit, receive, and link activity. Also behind the panel are the server's floppy drive, CD-ROM drive, and two 3.5-inch drive bays.

Behind a second, non-lockable panel are six hot-swappable drive bays. On our test configuration, five of these bays were occupied with 2GB IBM Fast/Wide SCSI-2 hard disks: four for the RAID 0 array and one for the operating



The HP NetServer gets high marks for management, but low marks for performance.

HP NetServer LH Pro

Street price: Dual 200-MHz Pentium Pro CPUs, 256K external cache per CPU, 128MB of RAM, five 2GB hard disk drives, RAID adapter, \$14,690

Hewlett-Packard Computer Co., Palo Alto, CA; 800-322-4772

www.hp.com/go/

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Bit Depth	36	30
Colors	68.7 billion	2.0 billion
Maximum Resolution	4800 x 4800	2400 x 2400
Optical DPI	600	600
Grayscale Levels	4,096	1,024
SCAN SPEED-Preview	6 seconds	11 seconds
Color (4x5)	21 seconds	27 seconds
Grayscale	23 seconds	34 seconds
Text OCR	14 seconds	28 seconds



The Expression 636 executive PC bundle comes with Adobe Photoshop® LE, Xerox TextBridge Pro™ '96, NewSoft® Presto! PageManager® LE and SCSI interface and cable. As well as a competitive edge.

YOU'VE GOT TO SEE IT IN **EPSON** COLOR.

Product comparison based on independent third party testing using a 200 MHz Pentium computer with Windows 95. Scanners were operated in best quality mode using Adobe Photoshop, TWAIN drivers and SCSI cards included in the box. Images were single-pass scanned at 400 dpi. Executive Mac bundle also available with Adobe Photoshop LE, e-Paper™ and SCSI cable. Other scanner configurations available. EPSON is a registered trademark of Seiko Epson Corp. Expression and TrueScan are trademarks of Epson America, Inc. All other trademarks are the property of their respective owners. ©1997 Epson America, Inc.

CIRCLE 048 ON READER SERVICE CARD



First Looks

system. All of the hot-swap disks were easy to remove.

To get inside the PC Server, loosen six screws from the back panel. All of the screws are secured onto the cover, so they won't be lost. A helpful road map on the top of the chassis details the layout and jumper setting for the system and processor boards. Although it contains instructions on how to upgrade system memory, it's not as comprehensive as that on the HP NetServer.

The PC Server's motherboard is designed and manufactured by IBM. Like the NetServer, it utilizes a daughterboard for the processors and memory. Using 256MB DIMMs, system memory can be upgraded to a total of 1GB. There are three dedicated EISA slots as well as five shared

PCI/EISA slots. On our test configuration, four of the PCI slots were used by IBM Fast Ethernet adapters. The final PCI slot housed a Mylex Fast/Wide SCSI-2 two-channel RAID controller with 8MB of ECC RAM. This

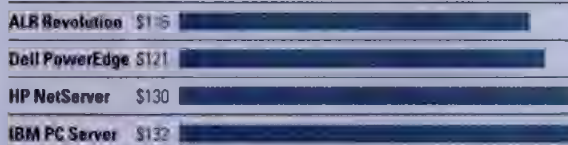
also provides integrated infrared and 10-Mbps Ethernet—the only server in this roundup to offer these features. The PC Server 330 uses a single 350-watt supply, but there is no second redundant supply option.

Finity RAID services configures your server's RAID array, and Diskette Factory creates driver and diagnostic disks. CoPilot helps you install Lotus Notes 4.1, TME 10 NetFinity, and IBM AntiVirus, which are included.

During ZD ServerBench testing, the PC Server 330 was competitive at low client loads, but its performance dropped off rapidly as more clients were added. At between 24 and 60 clients, the throughput levels reached by the PC Server ran neck-and-neck with NetServer, even though the PC Server had the benefit of 512K-cache CPUs.

Testing for this story was conducted by Steven Chan, Gregory Dohs, and Shawn Kafaipour of Ziff-Davis Labs.

Server Value: Cost per TPS*



* Transactions per second at full 60-client load

adapter is powered by a 25-MHz Intel i960 processor and features two external SCSI connectors.

IBM provides an Adaptec 7880 Ultra Wide SCSI controller on the motherboard. The board

IBM offers ServerGuide, an excellent server-management package. AutoPilot detects all installed devices and provides you with the utilities you'll need to configure the server. The Net-

DVD DRIVES

World Premiere Drive

Creative Labs' PC-DVD kit lets you take advantage of 4.7GB "movie-on-a-disk" technology.—By Alfred Poor

With the first Digital Video Disk (DVD) upgrade kit on the market, Creative Labs stands at the threshold of a new era in computing. The \$500 (street) Creative PC-DVD includes everything you need to be able to read DVDs, regardless of whether they contain a software application or a feature-length movie.

The PC-DVD kit includes the Matshushita-made drive, which can play CD-audio disks, read CD-ROMs at 6X speed, and read DVDs at 9X speed. The drive connects to an IDE interface and can use either the primary or secondary channel as master or slave. Because DVD uses MPEG-2 to compress the disk's video stream, the system has a PCI audio and video decompression card, which also comes from Matshushita. The card works with the new Dolby AC-3 audio signal that provides five-speaker surround sound (without an AC-3 compatible

amplifier, you'll have to settle for standard stereo sound).

You'll need a standard graphics adapter and sound card. The kit includes special pass-through cables to connect these cards to the PC-DVD's card. The system also has regional copy-protection hardware required by most movie titles.

The installation went smoothly, but you have to install drivers for Windows 95. Special software included with the kit made it easy to play MPEG files, but we needed to configure our display for 800-by-600 resolution at 16-bit color depth and 60-Hz refresh rate to get the best results. The MPEG video is displayed in an analog window on the screen, and you have to configure the image size for your display. As expected, the drive moves data in a hurry. As a CD-ROM drive, it scored

605 thousand bytes per second (Bps) on the ZD CD-ROM WinMark 97 test. The drive's 935-thousand-Bps sequential transfer rate for 8KB records is slightly better than the typical 6X CD-ROM drive. There is no definitive test for DVDs yet, but when we transferred 357MB from a DVD drive we got a transfer rate of 1.25 MBps, which is only slightly slower than the 1.35-MBps specification.



NUMERO UNO: Creative Labs' Creative PC-DVD is the first DVD upgrade kit available.

Although full-screen video will seem like a breath of fresh air for PC users, the system exhibited some pixelation and aliasing on close-ups with rapid motion. In addition, the PC-DVD's Windows 95 driver that we used did not implement all

the multimedia MCI commands, which could lead to problems with some DVD-ROM titles. An updated driver is expected from the Creative Labs Web site.

It wasn't always possible to get the image to fill the window completely, unless we correctly set the display refresh rate. Finally, if you expect to be able to read a CD-Recordable disk with the first generation of DVD drives—the PC-DVD included—you'll be disappointed. DVD vendors are saying that the next generation will be able to read CD-R disks.

Expect to see other companies (including STB Systems and Toshiba) come out with similar products. But for now, Creative Labs' PC-DVD kit is a vanguard product that lets you be the first one on your block with a DVD drive in your computer.

Creative PC-DVD. Street price: \$500. Requires: 16MB RAM, 5MB hard disk space, full-length PCI slot. Creative Labs Inc., Milpitas, CA; 800-998-5227; www.creativelabs.com. Circle 412 on reader service card.



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First Looks

WORD PROCESSING

A True-Blue OS/2 Pro

Lotus's Word Pro 96 is a real step forward for OS/2 word processing. —By Brian Proffitt

With its \$105 Word Pro 96 for OS/2 Warp, Lotus has at long last filled the void with an updated mainstream word processor for OS/2 users. There are several noteworthy features in Word Pro 96 that should send OS/2 users scurrying to remove Microsoft Windows word processors from their systems.

The most obvious change since the last version of Word Pro is the addition of tabs that optionally appear at the top of your document and allow you to divide large documents into sections. They are much easier to use than bookmarks and provide a visual cue to your location. We were even able to drag and drop entire sections of text using these tabs. When you use the vertical scroll bar to move through your document, the text doesn't move immediately. Instead, a Page Gauge pops up to let you know where you are in the document.

PANE IN THE...

Another visible change is the availability of customized views of your document. You can split the window, allowing two sections of a document to be viewed simultaneously. And predefined special views allow even more interesting ways to display your document. Through split-pane windows, for example, you can see a draft window, a page window, and a thumbnail of the entire document simultaneously.

All object properties (from plain text and graphics to page layout and table cells) are modified using InfoBoxes. These

new graphical controls have a bit of a learning curve. But in the long run, a common technique for customizing all objects makes producing professional documents much easier.

Word Pro 96 shines in a connected environment, with tools

sites as easily as when using a local disk. You can highlight a URL within a document and access that location or do a Web search on selected text.

Word Pro 96's SmartCorrect checks your document for a list of commonly misspelled words and automatically replaces any mistakes. We were able to add items to this list easily in order to include technical terms we use frequently.

The on-the-fly spell-checker has an annoying interface,

though. In its zeal to highlight incorrect words, the spell-checker sometimes highlights partial words before you finish typing them, but we could not discern a pattern in the times it chose to do this. And when an incorrect word is

highlighted, you must first click on the word and then move the pointer to the spell-check button to bring up a list of suggested alternatives (instead of right-clicking to bring up the spell-check context menu). Worse, even if you add the objectionable word to your dictionary, the highlighting often remains.

sent the appropriate help panel, often with an animation that shows you how to accomplish the task.

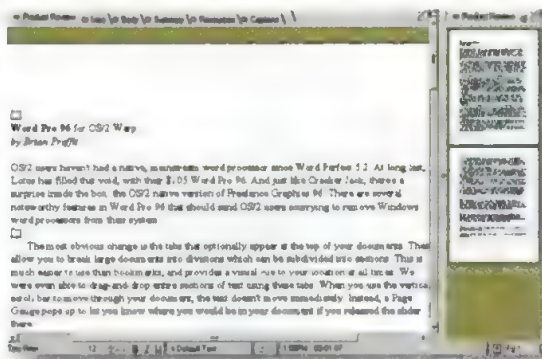
The Help files can be handy, because most printed documentation is online and Lotus chose to ship documentation files as .PDFs. But Acrobat Reader is a Windows program, and we had to go back to the OS/2 Warp CD and install Windows OS/2 support on our OS/2-only machine before we could read the documentation.

AND A PRIZE

The included vector-based drawing program is fairly complete for a bundled program; it includes the ability to layer objects, but it doesn't work on imported graphics. Frames are used to set off graphics, drawings, or sections of text that you want to stand out from the rest of the document. Just like a Cracker Jack box, there's a surprise inside: the OS/2 native version of Freelance Graphics 96. When Lotus completes the OS/2 versions of Approach, 1-2-3, and Organizer later this year, Word Pro and Freelance will be available as part of a complete SmartSuite for OS/2.

Word Pro 96 is much faster than the versions of Ami Pro that Lotus previously offered OS/2 users. It provides a level of power, ease of use, and mainstream acceptability that has been lacking in the OS/2 world. Getting the full-featured Freelance Graphics along with it is just icing on the cake. **Word Pro 96 for OS/2 Warp.** List price: \$105. Requires: 16MB RAM (24MB recommended), 47MB hard disk space, OS/2 Warp 3 with FixPak 26 or later,

or OS/2 Warp 4 with FixPak 1 or later; Lotus Development Corp., Cambridge, MA; 800-343-5414, 617-577-8500; www.lotus.com. Circle 401 on reader service card.

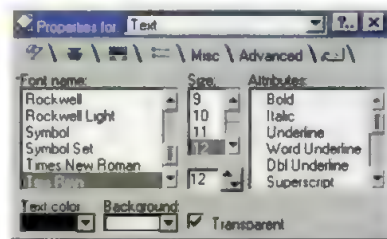


WIDE VIEW: Panorama is one of four optional views that allow you to work in draft and page layout formats.

allowing multiple users to contribute to a document. Team Review allows several people to work on the same document simultaneously; Team Consolidate acts as an intelligent agent for merging the separate edits. And versioning allows you to keep several revisions of a document without saving multiple files.

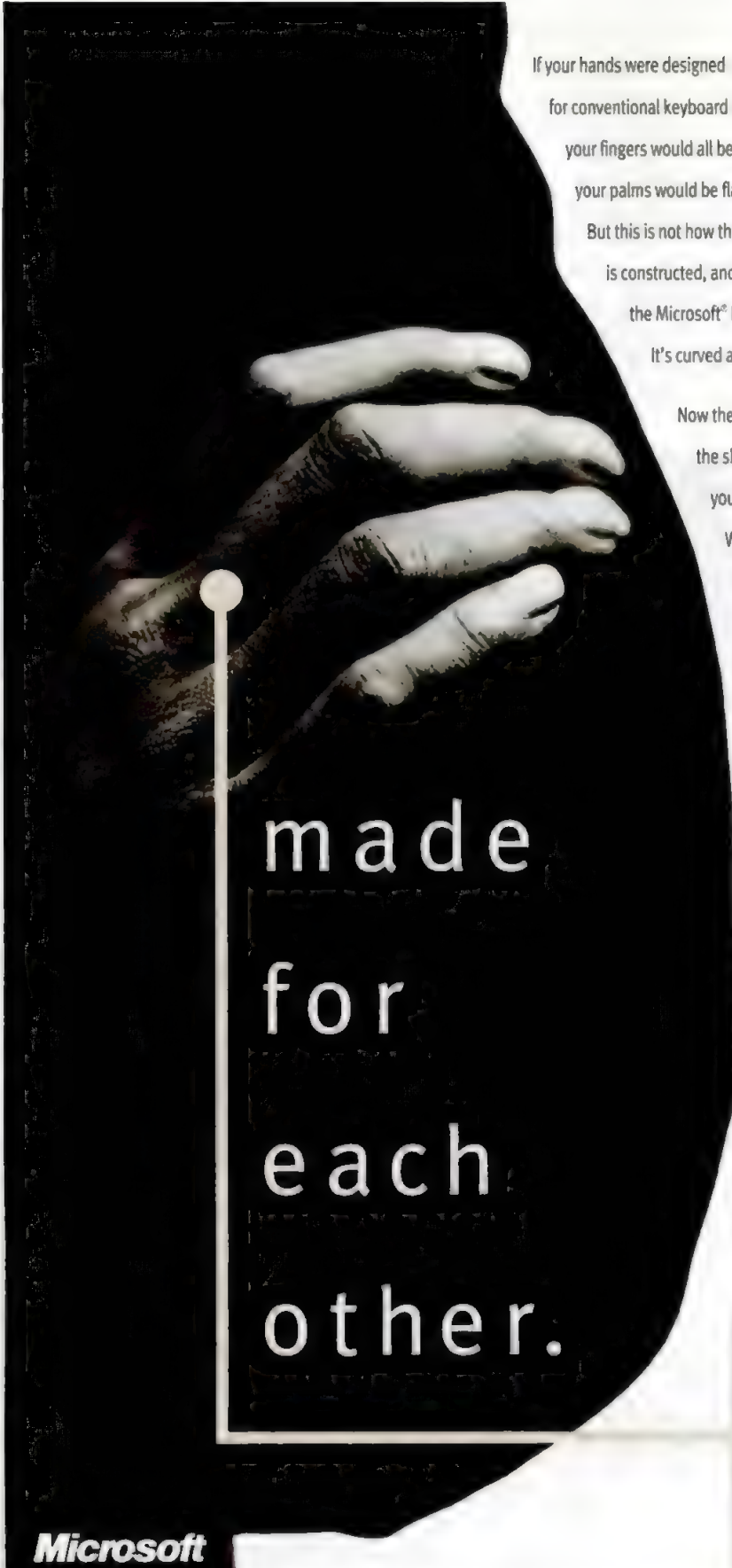
You can define a list of people who can review a document and specify whether they can make changes directly to the document. You can also use markups to identify proposed changes or make comments through highlighting and electronic sticky notes. Documents can be routed for approval by sending them either to everyone in a workgroup setting at once or to one person at a time in sequence. In fact, you can send and receive e-mail without leaving the program.

Word Pro 96 is also Internet-friendly. You can open and save documents in FTP and Web



BOXED SET: Changes to page layout and text appearance are made through pop-up notebooks called InfoBoxes.

Word Pro 96's Help files include an expert system designed to understand free-form queries. You can input "How do I...?" and the expert attempts to interpret the query and pre-



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First Looks

MAPPING

High-End Mapping Mania

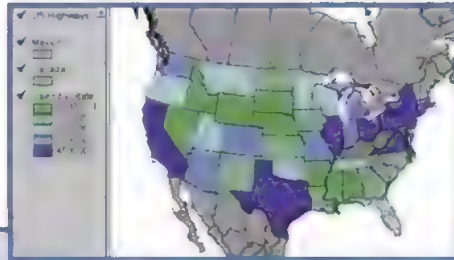
New releases from MapInfo and ArcView can make creating maps as easy as 1, 2, 3.—By Barry Simon

Just as Adobe PageMaker and Corel Ventura turned us all into potential publishers, desktop-mapping products have the chance to turn us all into cartographers. Geographic Information Systems (GIS) have remained something of a niche thanks to high prices, difficulty of use, and a basic lack of understanding about their usefulness. Fortunately, some improvements on all three fronts have carried precise mapping over to the desktop.

Maps possess the uncanny ability to display data in a way that is compelling and immediately understandable. But the business importance of mapping transcends mere presentation. Mapped data can be a powerful analytical tool for siting new stores, focusing marketing efforts, and even looking for your next customers.

Even though MapInfo Corp. has long been the major player in the PC-based GIS market, ESRI's ArcView is the Unix standard. ESRI brought its product to Windows and incorporated Atlas GIS, a major MapInfo competitor, in order to strengthen its PC presence. We looked at recent releases of these vendors' flagship products: the \$1,195 ArcView GIS 3.0 and the \$1,295 MapInfo Professional 4.1.

At the 30,000-foot level, these programs are similar. Both products can display data



DATA DIVA:

Once you have selected objects in an ArcView map, you can easily pop up a list of data rows with the selected objects highlighted.

geographically and build applications based on location. They each use layers to place different sets of data (for example, state borders, rivers, or census information) on the basic map. Both have two kinds of data files: conventional data files and boundary files, which provide raw placement of such geographic objects as ZIP code borders.

Both MapInfo and ArcView make use of a process called geocoding,

CLICK HERE: MapInfo's interface includes a profusion of buttons, which only serves to confuse users.

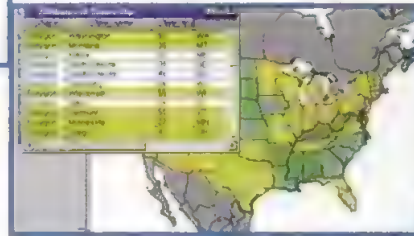


which links data with geographic location. In a customer database, for instance, the address field of each customer record could be associated with a ZIP code.

Mapping files typically provide necessary data as well as boundary information. For example, we tested extensively using the boundaries of census tracts together with census data. Though each product comes with enough base data to get you started, it's likely you'll need to purchase addi-

tional data for detailed applications. For example, ESRI sells a \$495 four-CD set of boundary files that contain U.S. city streets. MapInfo provides a 100-page catalog of files that are sold by the company and third parties.

For producing turnkey mapping applications, each product includes a Basic-like programming language. ArcView's language tools are included with the product, so we looked at them as part of this review. Though programs written in MapInfo's MapBasic language will run



in the base product, documentation and the language compiler require a separate product that we didn't review. We hope that both vendors will move to VBA and provide macro capabilities.

Because it uses Windows conventions and protocols intelligently and comes with thematic map wizards, MapInfo is the more impressive of the two GIS packages that we reviewed. Nevertheless, when you're working at this level of geographic precision, X really does mark the spot.

ESRI

ArcView GIS

From its 500MB of data to its included programming language to its add-on architecture, ArcView is a complete mapping suite.

A new add-on architecture

will allow ESRI and third parties to extend the basic program. ArcView includes over a dozen add-ons, and ESRI is selling a Spatial Analyst extension for studying raster maps and a Network Analyst for finding optimal paths through geographic networks.

ArcView's greatest strength is the way it allows you to set up a color-coded thematic map; just tell the program to use a gradient between two given colors or a number of good-looking dichromatic and trichromatic schemes. ArcView automatically fills in the intermediate values.

Though the interface can be frustrating, Arcview is modeled after a Windows Explorer-like project window. The left pane has icons for

THEME-DREAM:

ArcView's maps have a list of themes (layers) to their left and allow easy, direct modification.

themes (ArcView's name for layers) such as Views, Tables, Charts, Layouts, and Scripts, while the right pane displays the attributes of a selected theme.

Controls for changing any aspect of the maps are accessible, but we found their placement puzzling at times. Also, they aren't standard for users of other Windows 95 products. For example, you can edit a title in a dialog box by double-clicking on the title. But the font used in that title isn't found in that dialog box. Instead, it's located in a selection from the window menu.

Another example of this potential confusion is the Theme menu. Expecting to see Add Theme or Delete Theme? Guess what: You won't. They are located in the View menu and Edit menu, respectively.

Because the program uses special libraries to utilize the same code base in its PC and Unix versions, there are some

other nonstandard elements. For example, even if you have set up Windows to use large cursors, they remain standard size in this program.

Only dBase, text, and ArcInfo databases can be directly accessed, although you can tap into SQL and ODBC data in a round-about way. ArcView does not support OLE to transfer a map to other programs, and it can transfer a map via cut and paste only in .BMP format.

ArcView is notable for putting a lot in the box. The package comes with a CD that contains 500MB of data files, including 5-digit ZIP code and U.S. county boundaries, census-tract boundaries and census data, highways, and detailed data on foreign countries. There is also a complete object-based language that is reminiscent of Visual Basic. You can access much of the functionality of ArcView, but the lack of OLE automation denies access from other programs. You can set up dialog boxes to interact with the user, but there is no visual dialog-box editor.

ArcView is an attractive product that provides you with the ability to create truly detailed and effective business maps. On the other hand, its interface is occasionally confusing. In addition, a more current macro language would help users overcome some obstacles.

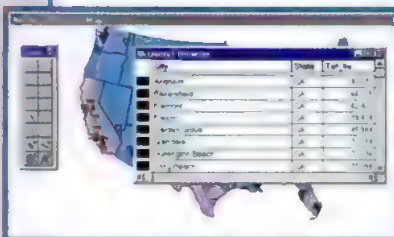
ArcView GIS, Version 3.0. List price: \$1,195. Requires: 12MB RAM, 70MB hard disk space, Microsoft Windows 3.1, Windows 95, or Windows NT 3.51 or later. ESRI, Redlands, CA; 800-447-9778, 909-793-2853; www.esri.com. **Circle 408 on reader service card.**

MapInfo Corp.

MapInfo Professional

MapInfo Professional is like a complex jigsaw puzzle: All the pieces fit together to create a cohesive whole.

SELECT ALL: MapInfo lets you pick all objects within another object. As shown here, you can select all cities within California.



Unfortunately, this otherwise superb program requires more effort to use than ArcView.

MapInfo makes excellent use of Windows interface elements, and it supports Windows standard protocols. Its toolbars can be floating or dockable. Tooltips are available for iconic buttons in dialogs as well as in system-level toolbars. Layer editing is done via a dialog box brought up from a toolbar, button, or menu choice. This makes for a cleaner-looking and less cluttered screen than ArcView's, but such a simple change requires more mouse or keyboard action.

The program supports OLE in three ways. First, it can act as an OLE server with in-place editing, which allows seamless placement of maps in a program such as Microsoft Word. This means that you can drag and drop a map from the MapInfo window into a program that acts as an OLE container. Second, its macro language supports OLE automation, allowing a program such as Microsoft Excel to access MapBasic scripts. Finally, support for OLE automation commands allow other programs to use MapInfo to generate maps from scratch.

With MapInfo, it's easy to set up thematic maps with nonrange data. Virtually all GIS programs let you easily color code objects according to the range of values within a single parameter. MapInfo goes a step further by letting

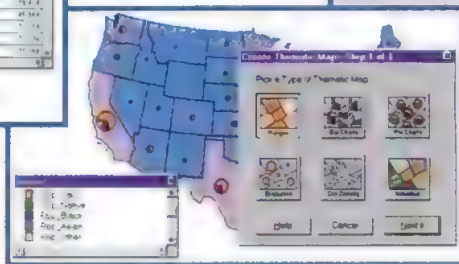
you easily draw maps with pies or bar charts of several types of data. You can build such maps with ArcView, but the process is more involved.

New to this version is a button that can clone the current view to try "what-if" scenarios without disturbing the underlying data. Also new is

within a given area, all objects of one type within an object of another type, or all objects within a rectangle that you can draw on a map.

MapInfo Professional 4.1. List price: \$1,295. Requires:

MAP WIZARD: MapInfo lets you make maps with attached pies or bar charts through the help of a simple wizard.



8MB RAM, 20MB hard disk space, Microsoft Windows 3.1, Windows 95, or Windows NT

the ability to directly read Microsoft Access files rather than rely on ODBC and SQL statements. MapInfo selection tools let you choose all objects

3.51 or later. MapInfo Corp., Troy, NY; 800-619-2333, 518-285-6000; www.mapinfo.com. **Circle 409 on reader service card.**

Digital Dynamo

Satellite images have changed the way we view our world, so it's natural for some applications to use digital images as the basis of maps instead of vector graphics, which are normally drawn by mapping programs. SPOT Image Corp., which mainly uses pictures taken by the French SPOT satellites, provides geocoded images of everything from your backyard to potential factory sites. We looked at some of the images in its Los Angeles Metro collection, which is provided in .TIF format with geocoding included in the .TIF header. It was easy to import them into ArcView and MapInfo.

The \$495 MetroView includes 15-minute by 15-minute cells (about 250 square miles) of a particular metropolitan area. Some large areas require multiple cells—for example, the greater Los Angeles area encompasses 20 cells in all. A total of 29 different U.S. metropolitan areas are available.

The MetroView images have a 10-meter resolution, meaning you can make out a school bus but not a tricycle. SPOT Image plans to release a Sweet SPOT series of geocoded aerial images with a half-meter resolution.—BS
SPOT MetroView. Price: \$495 (per city); SPOT Image Corp., Reston, VA; 800-275-7768, 703-715-3100; www.spot.com.



HOME SWEET HOME: Here's a satellite view of a section of Los Angeles brought into ArcView.

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the dotted line
for a handy
do-it-yourself
bookmark.
And avoid
getting ripped
off by the
other guys!

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Yes #P 722 4MB VRAM Video 3D

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Q: 3 4.3GB 10,000 RPM Ultra Wide HD
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Sony 16x CD-ROM
Keyboard, Floppy, Mouse
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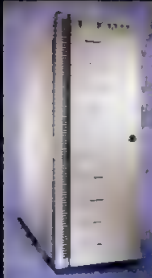
Dual Pro 200 MHz
DMI Compliant Intelligent Management Software on Board
1 Intel Pentium Pro 200 MHz Upgradable to 2 CPUs
64 MB of 60 ns RAM Expandable to 512MB, ECC Supported
Integrated on Motherboard:
• Adaptive 2940 UW
• 16 Bit Sound
• Intel 10/100 PCI Ethernet
Open Slots: (3) PCI, (1) ISA
4.3GB 7200 RPM Ultra Wide HD
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First Looks

MULTIFUNCTION DEVICES

Fax-o-Matic

The WorkCentre Pro 535's laser print engine makes this multifunction printer stand out.—Alfred Poor

Designed to fit in the middle of Xerox's \$1,100 multifunction printer lineup, the WorkCentre Pro 535, which is aimed at business professionals and SOHO buyers, is a mix of attractive features and annoying shortcomings.

On the plus side, the WorkCentre Pro 535 resembles a standalone fax machine complete with telephone handset, and it's just as simple to operate. Lurking beneath the surface is a 300-dot-per-inch (dpi), four-page-per-minute (ppm) laser print engine that offers



HARD WORKER: Xerox's WorkCentre Pro 535 cranks out 300-dpi laser prints.

quick, quiet, and clean output. The 20-sheet automatic document feeder makes the WorkCentre Pro convenient for pro-

ducing photocopies; you can make up to 99 copies per original with six preset reduction settings and an effective error-diffusion halftone setting for photographic originals.

The unit has many of the features you'd expect from a high-end fax machine: speed and group dialing and automatic-reduction of legal-size faxes. With the optional \$199 2MB memory upgrade, the system can hold up to 155 pages at a time.

In tests with a 15-page Word for Windows document, the printer managed only 3-ppm output. It was worth the wait, though, because print quality was very good.

The printer uses GDI technology, which only works with Windows 3.x or Windows 95 applications; you can't use it to print

from a DOS application.

The scanner's resolution is only 200 dpi, though it does have an enhanced 200-by-400 dpi mode. You also can't scan to your PC, despite the printer's use of a bidirectional parallel port and a serial-port connection to your computer. The input paper tray holds only 160 sheets of paper, and there is no provision for printing envelopes or labels. In addition, there is no manual feed option.

Xerox's laser-printer-based WorkCentre Pro 535 will be ideal for those whose primary needs are traditional faxing tasks.

WorkCentre Pro 535. Estimated price: \$1,100. Requires: 4MB RAM, 5MB hard disk space, Microsoft Windows 3.x or Windows 95. Xerox Corp., Rochester, NY; 800-275-9376; www.xerox.com. Circle 402 on reader service card.

VIDEO

Broadway's Revival

Need high-quality PC-based digital video? Head down Broadway.—By Jan Ozer

Data Translation's \$995 Broadway 2.0 MPEG-1 capture board produces better quality video than any other low-end MPEG-1 encoder, and it's the first one to enable both real-time and two-pass compression. Excellent as an inexpensive entrée into the world of digital video, Broadway does manage to stumble a bit in real-time encoding.

Broadway is a half-length PCI bus master card built around C-Cube's new CL-4110 capture and encoding chip. The board accepts S-Video and composite input in both NTSC and PAL video formats. The system comes with Data Translation's capture and compression software and Ulead's MediaStudio video editor.

Broadway functions in two modes: real-time capture to final MPEG-1 output and capture to

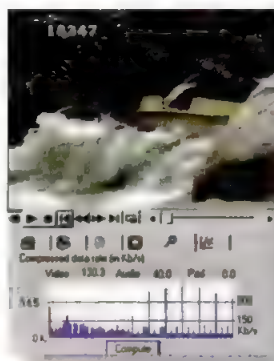
.AVI format for editing and later compression. In two-pass mode, the C-Cube chip handles encoding to final MPEG-1 format in about three times the length of the clip (compared to about 60:1 for many software MPEG-1 encoders). With Broadway's engaging utility, you can adjust video data rate, audio parameters, brightness, and color. A softening filter improves overall quality at the cost of some image sharpness.

You can perform basic cut-and-paste editing within Data Translation's program or save the .AVI file and edit externally. Either way, you compress the clip to final MPEG-1 format within Broadway's utility, which provides a full range of output presets, including VideoCD and a format for streaming Internet delivery. New in Broadway 2.0 is a square-pixel option, which con-

verts the video from MPEG-1's 352-by-240 pixel resolution to true quarter-screen VGA resolution.

Unfortunately, when capturing directly to MPEG-1 format, you can't output in square-pixel format. In addition, neither approach gives you any control over MPEG's I-, B-, and P-frame intervals. You also are unable to input an I-frame at scene changes or other locations.

In general, files captured and compressed in real time looked slightly better than two-step encoded files. For example, Broadway stuttered during the first few frames. This resulted in excessive blockiness for the first 60 frames. Broadway doesn't offer machine control over the video source, making capturing an exact sequence a hit-or-miss proposition.



ON BROADWAY: Data Translation's Broadway 2.0 does a good job of capturing motion on a video clip.

Data Translation's software can't edit compressed MPEG-1 files; you'll need a third party program to remove any unwanted frames. During non-real-time compression, Broadway avoided up-front quality degradation. But compared to real-time clips, fine details were a bit obscured

and the video was slightly noisier, primarily because the frames had been compressed twice.

Broadway 2.0 is a great buy for most digital video tasks.

Broadway 2.0. List price: \$995. Requires: 16MB RAM, 30MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later, PCI slot. Data Translation Inc., Marlboro, MA; 800-249-1000; fax, 508-788-1539; www.b-way.com. Circle 403 on reader service card.

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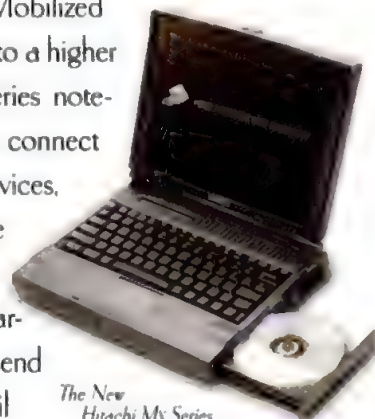
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First Looks

COMMUNICATIONS

Communications Central

WinFax PRO 8.0 continues to be the industrial-strength fax and communications program.—By J.W. Olsen

Clearly focused on serious business-user needs, Symantec's \$100 WinFax PRO 8.0 adds major enhancements and smoothes rough edges found in Version 7.0 (First Looks, March 12, 1996). The result is a communications powerhouse that makes a small business look even bigger.

The center of attention is the Controller, an icon that appears in the Windows taskbar (or as a minimized app in Windows NT 3.51). The Controller gives you instant access to major WinFax functions without loading the entire program. This will be a boon for users with less than 16MB of RAM (such users widely reported sluggish performance with the previous version). A separate taskbar icon appears after new faxes or voice mail messages arrive.

WinFax itself now loads in a more sprightly manner, provided you don't configure it in integrated Microsoft Exchange mode. Unfortunately, WinFax still can load very slowly when integrated with Exchange.

Our first attempt to receive a fax failed because WinFax did not handshake properly with a standalone fax machine. Nevertheless, WinFax's innovative self-correcting fax-driver architecture impressively learned from its error and consistently received subsequent faxes.

Enhancements to the TalkWorks voice mail module now provide a complete fax and voice mail center if you have a supported voice/fax modem and preferably a sound card. The voice answering machine provides up to 100 discrete voice mailboxes, while speakerphone functionality offers programmable speed dialing, caller ID support, auto-redial, and music on hold.

Integrating voice and fax ca-

pabilities, fax-on-demand lets callers select from a list of documents to have faxed to them. Our favorite feature is the ability to set up modems, which allowed us to do several things at once and look like a larger organization. Broadcast faxing takes a great leap forward thanks to support for ACT! phonebooks. A previous bug made faxing directly from Microsoft Word unreliable, but this has now been fixed.

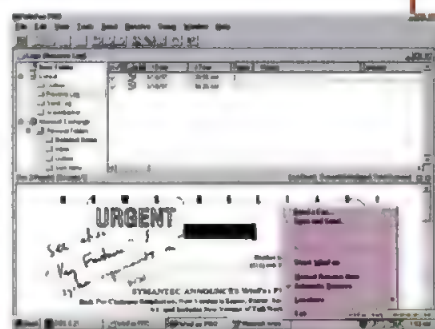
WinFax's cover-page wizard makes it easier to create a custom fax cover page; you can also choose from 100 supplied designs. And throughout the program, other new wizards and ToolTips make WinFax

easier than ever.

WinFax PRO continues to attend to the many details that made it a leader. You can preview and edit faxes, and then you can schedule them to send at off-peak hours. Call discrimination distinguishes incoming fax, voice, and data calls, and we found that WinFax operates in harmony with other active telecommunications tools as well.

Road warriors will appreciate remote fax and voice mail retrieval, phone card dialing, fax auto-forwarding, multiple-location configurations, and pager notification. If you have an Internet fax service, you can send long distance and international calls almost as cheaply as local faxes.

For many, this program's depth is overkill. But for industrial-strength needs, WinFax



STAY IN CONTROL: The WinFax Controller provides instant access to all of the program's major functions.

PRO 8.0 is the one-stop fax and voice mail center.

WinFax PRO 8.0. Street price: \$100. Requires: 8MB RAM (16MB recommended), 44MB hard disk space, Microsoft Windows 95 or Windows NT 3.51 or later. Symantec, Cupertino, CA; 800-441-7234, 541-334-6054; www.symantec.com/winfax. Circle 404 on reader service card.

PDAS

The Zaurus That Could

With e-mail, a modem, and Windows synchronization, Zaurus challenges Windows CE.—By Robert Anthony

It's not an organizer and it doesn't run Windows CE, but Sharp's \$500 Zaurus ZR-3500X PC companion offers some of the advantages of both in a 12-ounce, pocketable package.

Of similar size and heft, the ZR-3500X provides some features that many Windows CE units don't offer, such as a spell checker. The unit has an infrared port and an integrated 14.4-Kbps fax modem with a pop-out phone jack—a vast improvement over Zaurus's clip-on 9.6-Kbps fax modem.

Based on 1MB of RAM and 1MB of flash memory, the Zaurus ZR-3500X comes

equipped with some useful software, including a Micro-



CEP, NON: Sharp's Zaurus ZR-3500X offers an e-mail-centric alternative to Windows CE systems.

soft Word-compatible word processor, an Excel-compatible spreadsheet, a contact manager, and a remote-access utility. The unit's CompuServe utility

offers access to e-mail as well as to forums. We really liked Rupp Software's Z-Em@il, which supports Internet e-mail with attachments.

The included Zaurus Application Partner software comes with import/export and synchronization tools for major Windows 95 applications such as Lotus Organizer 97 and Microsoft Schedule+. Files can be dragged and dropped to start the import/export process. The Scrapbook allows you to draw on the touch screen and save the image as a file so that you can paste a signature or hand-drawn map into a document and then fax it.

The 320-by-240 pixel touch screen display is smaller than that of Windows CE units, but it has a backlight and offers access to key features.

Zaurus ZR-3500X. Street price: \$500. Sharp Electronics Corp., Mahwah, NJ; 800-237-4277, 201-529-8200; www.sharppusa.com. Circle 405 on reader service card.



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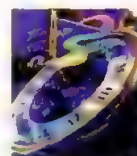
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First Looks

CONTACT MANAGERS

Beyond First Contact

These two PIMs target sales professionals with features that help them get down to business.—By Nelson King

Even with the help of your PC, staying on top of an ever-growing collection of personal and business contacts can be an uphill battle. Most contact-management programs are hard to learn and downright frustrating to use, so they end up just collecting dust.

Maximizer 97is and WinSales Client Vision 4.0 are working to change the landscape by making contact managers so intuitive and easy to use that sales and marketing professionals actually use them.

Maximizer Technologies

Maximizer 97is

To put it plainly, the \$99 Maximizer 97is simplifies keeping track of your contacts. Armed with a retooled user interface that takes advantage of Microsoft Windows 95, this version makes it easier to get information into and out of the program.

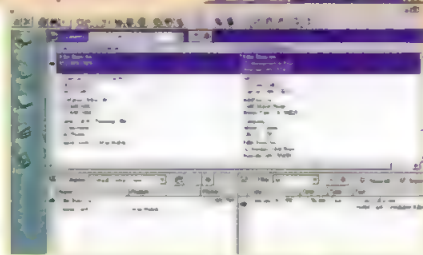
A key enhancement is the increased level of data entry automation. Whether you're logging calls or entering contact information, Maximizer now provides instant pop-up selection lists. A more subtle change involves Maximizer's use of the word "clients" instead of "companies" and "individuals." This seemingly minor difference simplifies the program's structure significantly. The benefits of this change can be seen in the Address Book, which now brings together all company and individual entries.

The Address Book automatically displays related contacts and notes. To facilitate the tracking of tasks and to-do lists, the Hotlist window is also

automatically linked with related contact information.

Maximizer is particularly adept at handling the details associated with correspondence. The call-logging feature is well-designed to accommodate logging both

ALL-IN-ONE:
Maximizer's Address Book view automatically displays contacts and notes, simplifying operation.



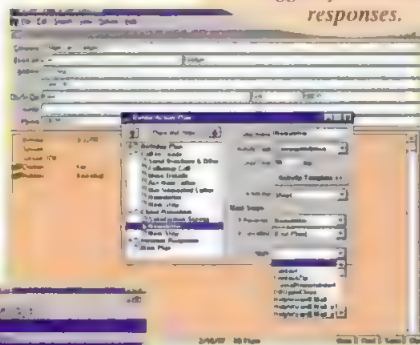
before and after a call. Although there's a built-in text editor, Maximizer's set of mail-merge links to Microsoft Word and Corel WordPerfect are more appropriate for daily use.

The calendar and date book are functional but not feature-rich. Maximizer lacks a year-long calendar view, and you can't edit the calendar directly. Maximizer's greatest weakness—particularly compared with such competitive packages as NetManage's ECCO Pro and GoldMine Software Corp.'s GoldMine—lies in its Internet integration. Maximizer links to your Web browser and can capture URLs directly from Web sites, but it can't do much more than that.

Once out of the box, Maximizer has good network capabilities, including extensive user security and data protection. In case you need to scale up, the Enterprise edition of Maximizer adds a client/server database system.

The biggest challenge that contact-management software faces today is in being used. Maximizer 97is is not the most richly featured of the group we looked at, but its usability makes it a winner.

TRIGGER FINGER:
At the heart of WinSales is the ability to define an action plan and program triggers for automatic responses.



Maximizer 97is List price: \$149. Requires: 8MB RAM, 10MB hard disk space; Microsoft Windows 95 or Windows NT 4.0.

Maximizer Technologies, Vancouver, British Columbia, Canada; 604-601-8000; www.maximizer.com. Circle 406 on reader service card.

WinSales Inc.

WinSales, Client Vision 4.0

WinSales Client Vision 4.0's extensive array of functions helps your sales force follow through on their leads. This version has all the usual elements you'd expect. But it adds features aimed at sales and marketing professionals, including telemarketing scripts, action plans, diagrams, expense reports, and more.

WinSales' strengths extend basic contact management into the realm of sales-and-marketing strategy. With action plans, WinSales can orchestrate a sequence of events that's automatically triggered by server-based data. As events occur, triggers created in a Visual Basic-like language can set off automated responses, such

as sending follow-up letters.

WinSales' \$1,495 Internet connectivity package, Universal Outbox, captures customer information from a Web page and transmits it via e-mail to a WinSales client.

The e-mail is then processed by WinSales' triggers for appropriate follow-up according to a given action plan (say, notifying sales reps or generating a response letter).

This kind of automation is ideal for long sales cycles where continued contact is vital. It's also an area where WinSales would benefit from a simplified interface and greater emphasis on graphical action plans.

Because of the nature of sales-driven contact management, it's easy to accumulate tons of data. To address this problem, WinSales lets you hook-up with Microsoft SQL Server. Getting started with SQL Server and WinSales requires a special configuration, and existing data needs to be converted. Once in place, the client/server arrangement is invisible and requires only routine administration.

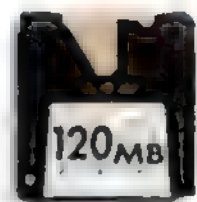
Caveats aside, WinSales 3.2, Client Version is a versatile sales-automation tool that can be configured, triggered, and up-scaled without an army of programmers. It brings ease of use, robust features, and a relatively low price to an arena that is characterized by cumbersome and expensive programs. WinSales is for those who are serious about making a sales or marketing organization more competitive. **WinSales Client Vision 4.0.** List price: \$695 per seat; \$10,000 per server package. Requires: 16MB RAM, 9MB disk space, Microsoft Windows 95 or Windows NT 3.51 and later. WinSales Inc., Bellevue, WA; 206-453-9050; www.winsales.com. Circle 407 on reader service card.



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Memory: RAM famished? You'll find it amply provided in a Compaq Deskpro. There's up to 64 MB EDO standard memory, expandable to 256 MB. Additionally, in a secondary cache, there's either 256 K or 512 K that gives you faster access to your data.



Maximized Storage: Did we hear someone say storage? How does 120 MB of floppy storage sound? Compaq was the first PC maker to offer the LS-120 Drive. With it you get increased data storage and faster transfer rates. And as an added bonus, it's backwards compatible to current 1.44 MB diskettes.



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First Looks

PROJECT MANAGEMENT

Projecting Yourself

Enhanced support and new features highlight Scitor's 32-bit Project Scheduler 7.—By Craig Stinson

Scitor's \$600 Project Scheduler 7 (PS7) has something for everyone who needs to track a complex project. With a report wizard, novice and intermediate users will find it simple to use. Advanced users will appreciate enhanced analytical abilities, improvements to the report generator, and more complete ODBC support.

PS7 can now work with raw SQL commands to import and export scenarios. You also have the option of getting a yes/no prompt for every item that meets your import criteria. In addition, PS7 handles custom fields, filters, and formulas, as well as time-distributed calculations.

The custom-field capability built into PS7 means that you can track such details as phone numbers, department names, division codes, resource grade levels, full-versus part-time status, and risk-factor levels. With custom formulas, the project manager can build a variety of what-if scenarios, such as the availability of bonuses for tasks and projects completed on or ahead of schedule.

Many longtime PS7 users will appreciate the ability to perform time-distributed calculations. This makes it relatively painless to graph total units expended versus baseline projections at any point in a project's lifetime.

PS7's report generator now handles word-wrapped text, and reports can include resource-filter and task-filter scope blocks. Meanwhile, the program's data-banding feature allowed us to sort tasks into groups based on any task field. There's also significantly expanded baseline support; where PS6 allowed one baseline per project, PS7 lets you use up to five baselines.

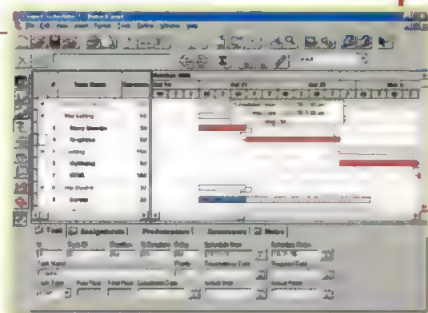
PS7 also does more than out-

put to paper: There's support for HTML and e-mail. When posting PS7 reports to Internet or intranet sites, users can create either standalone or template-generated pages, with or without a table of contents. Also, a Preferences dialog box lets you add HTML tags manually.

Scitor's new support for e-mail is less extensive than what's found in Microsoft Project. PS7 doesn't offer hooks to Schedule+, Outlook, or other scheduling programs. But the inclusion of basic messaging and routing capabilities makes up for a serious omission in Project Scheduler.

Overall, PS7 is a faster, more versatile program. Expect to see about a 30 percent improvement when using it for average projects. And with complete OLE support and an export option for Microsoft's .MPX format, PS7 should satisfy even more users. On the other hand, PS7's new Project Guides would be more effective if they were linked to the program's menus and dialog boxes. Nevertheless, they should prove helpful to those who find project management more of a mysterious art than a science.

Fortunately, the program's interface makes most of its power discoverable for the enterprising novice. At the other end of the spectrum, PS7's new analytic ca-



BAR NONE:

A click on one of PS7's Gantt bars displays summary information for the selected task.

abilities, added to an already rich feature set, make it a particularly attractive candidate for the serious project manager. **Project Scheduler 7.**

Street price: \$600; Requires: 16MB RAM, 15MB hard disk space, Windows 95 or NT 3.51 or later. Scitor Corp., Menlo Park, CA; 800-533-9876, 415-462-4200; www.scitor.com. Circle 410 on reader service card.

SCANNING SOFTWARE

Pagis Packs Punch

Xerox delivers impressive technology for making the most of your scanner.—By Barry Simon

Xerox's \$170 Pagis Pro 97 mixes image-enhancement technology, excellent optical character recognition (OCR), and a full-text-indexed search engine in an elegant interface that can help you maximize your scanner.

The center of attention is the program's floating button bar for scanning, copying, faxing, editing, searching, and getting help. The first three options scan originals using ISIS or Twain drivers and provide image cleanup and enhancement. It's impressive to watch Pagis Pro clean a spotted, smudged scan. TextBridge 96 OCR software includes support for several languages and proofing tools for working in Microsoft Word

and Corel WordPerfect.

Xerox's big news is the Xerox Image Format (.XIF), which is used to store compressed scans.



STEP TO THE BAR: Pagis Pro's Control Center is an elegant button bar.

There's worry about its compatibility with other programs, but Xerox has given it a good jump-start; Wang's Imaging for Windows includes .XIF support. And if you drag a .XIF file to an executable file in Windows Explorer or on Pagis Pro's Send To bar, it will be converted on the fly to a format that the target application understands.

The search engine in Pagis Pro is efficient at both indexing and retrieving items. It took about an hour to index 1GB of files. The index of a 10GB database took

up only 25MB of hard disk space, and the program found files on the indexed disks almost instantaneously.

Pagis Pro's search facility is a work-in-progress: You can't find the number of files indexed or the last time the index was updated. You also can't perform proximity searches or look inside compressed files. The biggest annoyance of all is the lack of a progress indicator.

Showing that the potential for a scanner is large, Pagis Pro has limited overlap with the Presto! Page Manager Suite. It would be useful if Xerox added a Business Card Reader and a Forms Manager to Pagis Pro.

Even with these shortcomings, superb image enhancement and color support make Pagis Pro the scanning suite of choice.

Pagis Pro 97. Street price: \$170. Requires: Windows 95 or Windows NT 4.0, 16MB RAM, 20MB disk space, scanner with Twain or ISIS support. Xerox Desktop Document System Division, Peabody, MA; 888-997-2447; fax: 508-977-2434; www.pagis.com; Circle 411 on reader service card.

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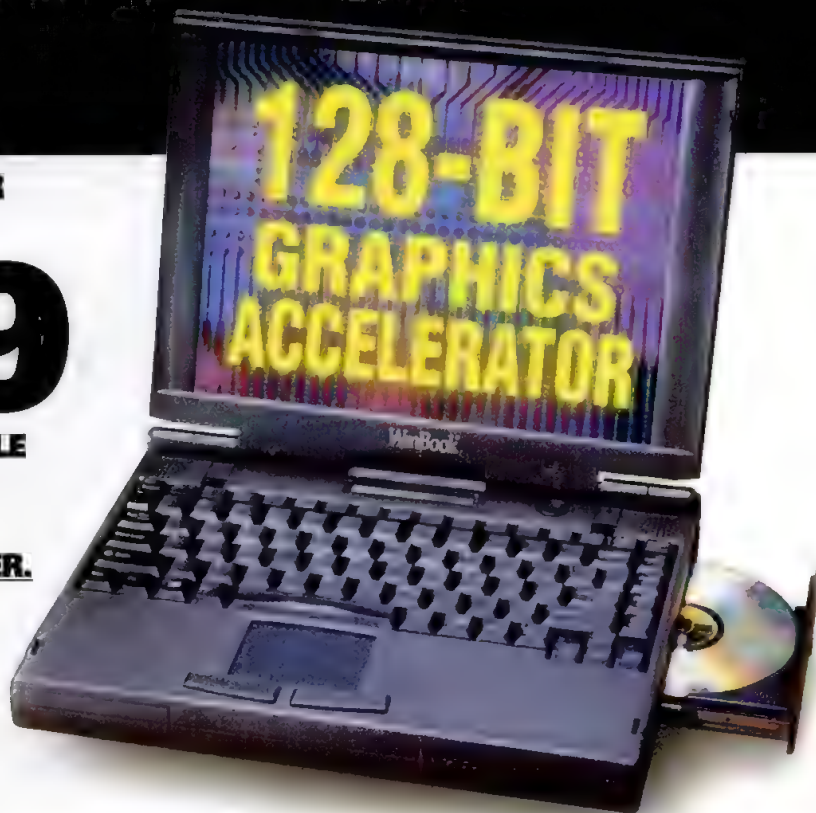
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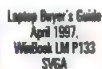
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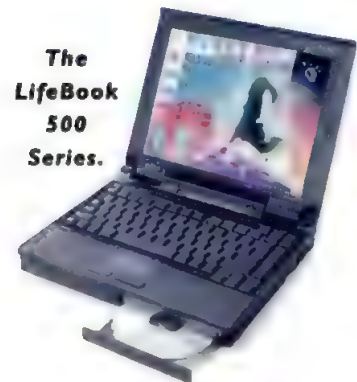
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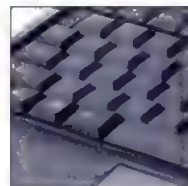
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Second Looks

ANTIVIRUS SOFTWARE

Not My Idea of Fun

When we last turned our attention to antivirus software, we were still getting used to handling macro virus infections, which can plague Microsoft Office installations ("The 1997 Utility Guide: AntiVirus Utilities," April 8, 1997). After using both McAfee VirusScan and Norton AntiVirus for the past several months, we can report that they both handle run-of-the-mill macro viruses.

The two products run neck and neck in combating the latest viruses, including the recent

ShareFun.A strain. Fresh from the system of a resourceful virus writer, ShareFun.A attacks users of Microsoft Word. The virus has its own insidious, built-in mechanism for spreading havoc: It selects several names at random from your Microsoft Mail address book—which is included in Microsoft Office—and then sends them infected messages.

You know your system is infected if you start seeing e-mail containing the phrase, "You have got to read this," in the subject line. After you open



the message, the ShareFun.A virus starts the whole process over by infecting several of your friends, who in turn infect several of their friends, and so on.

The key to stopping ShareFun.A is to cut it off before it has a chance to spread. Go to

www.mcafee.com to download the 30-day trial version of VirusScan. Or you can visit www.symantec.com/avcenter to update Norton AntiVirus. At press time, other antivirus developers were either searching for or phasing in solutions to eradicate this troublesome new PC pathogen.

NOTEBOOKS

The Skinny On SlimNote

As seen by the popularity of such skinny notebooks as the IBM ThinkPad 560 and the Twinhead SlimNote 710, there's no shortage of road warriors who are willing to give up a little performance for a 5.5-pound notebook that won't weigh them down.

When we first evaluated the SlimNote 710, two major prob-



lems stood out: an abysmal battery life of about half an hour (according to our ZD BatteryMark test) and a quirky BIOS that often left the system unstable ("Affordable, Portable

Notebook PCs," January 21, 1997). Twinhead engineers put their heads together and fixed both glitches. If you own a SlimNote 700 series system, you owe it to yourself to go to www.twinhead.com and download DECHARGE.ZIP (24K) and SL7R14E.ZIP (156K).

The first package contains a diagnostic routine for the SlimNote 710's Duracell nickel hydride cells. It also features a utility for conditioning and removing any lingering memory effect that would prevent the battery from fully charging. Start the system in DOS mode and run the program. But be warned: This diagnostic program can't be interrupted, so you won't be able to use the system until the battery's drained.

If the program's top line reports that the battery's remaining capacity is 200 milliamp hours (mAh), then you have no choice

but to replace the battery. On the other hand, if the remaining capacity is 280 mAh, you have to condition the battery by running the system down and recharging it at least three times. After that, it should hold a reasonable charge; we were able to run the SlimNote 710 for about 2 hours between charges.

Getting the BIOS fix into your system is a bit more involved. Start by transferring the BIOS upgrade files to a floppy disk. Then start the system from a bootable DOS disk, which is a good thing to have handy anyway. Type `A:/PHLASHP77V14E.ROM` and hit Enter to start upgrading the BIOS file (this should take no more than a few minutes). If you encounter a checksum error when you restart your PC, hit F2.

These two fixes go a long way toward making the SlimNote 710 a notebook that's fat on value.

SECOND LOOKS MAILBOX: Tell Second Looks about your experiences with computer products. Contact Brian Nadel via MCI Mail (556-1500), CompuServe (72241,1616), or the Internet (bnadel@zd.com).

BUG BRIEFS

Problem: An enterprising group of engineering students figured out a way to use Microsoft Internet Explorer 3.0 for Windows 95 or Windows NT as a portal for snooping on your PC while you're at a Web site.

Solution: You can download and install a patch to close this security hole. The software is available at www.microsoft.com/ie/security/update.htm.

Problem: The DirectX drivers for S3 Trio64V+ based graphics boards, including Diamond's Stealth64 Video 2201XL, were hardly barn burners when it came to game playing.

Solution: Get S3's generic driver ([ftp://ftp.s3.com](http://ftp.s3.com)) for the chip and concentrate on blasting away at those aliens.

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Help! My Cell Phone Has a Browser!

You've been hearing a lot about thin clients these days, but they don't get any thinner than this. I just got a cellular phone from AT&T Wireless Services, and darned if the little thing doesn't have its own built-in Web browser.

It's no ordinary cell phone: The PocketNet Phone has Cellular Digital Packet Data (CDPD) capabilities. I can't cruise the Web with it, but it can do things that no ordinary cell phone can dream about.

CDPD is a data protocol for cellular communications, based on the Internet's familiar IP protocol. It's transmitted over the existing cellular network but uses a whole different set of circuits. That makes the phone a larger, heavier handful—an unhappy tack away from today's ultra-slim phones. The extra circuitry in this phone does what you'd expect to power consumption. I can't give you a definitive picture of battery life; I'm still conditioning the batteries, but so far, it's not great.

You can send e-mail messages directly to the phone (it has an IP address), and you can send e-mail from the phone to any Internet address. It beeps like a pager when you get a message. Of course, I sent e-mail to myself to test it and was appalled when it took over 2 hours to show up on the phone. I replied to the message from the phone, and it took another hour or so for it to show up in my Notes in-box. The delay is entirely with our Notes implementation. Delays are much smaller from and to my private Internet account—a few minutes at most. So you can use the phone as a text pager with full reply capabilities, not just canned codes.

You have to be very highly motivated, however, to type out a message on the numeric keyboard. When you press the 2/ABC key, for example, you get an A on the first press, B on the second, and so on. It's a time-consuming and laborious task.

Although I can't access the Web per se, there really is a browser in there. The three-line screen gives me access to sports scores, movie listings, news headlines, stock quotes, nationwide phone listings and the Yellow Pages, and private intranet applications. The server determines what services I see, but they can be almost limitless in variety—free, subscription, and private. The applications' pages are written in Handheld Device Markup Language (HDML). It's a derivative of HTML but close enough that any Web-savvy devel-

oper can put together a phone-ready application.

Intranet builders will be especially interested in the PocketNet Phone's capabilities. Executives who want to be fully connected without lugging around a notebook and constantly searching for a phone jack will enjoy it. Middle-

ware products such as Infinite Labs' Interchange will let them scan and respond to their corporate e-mail from the phone. They'll also get a kick out of the sports scores and stock quotes. Sure, you can get a stock notification service on your pager today, but I've been in too many meetings where some guy's beeper gives him a joy buzz. He pulls it from its holster, studies it intently, and announces to those present, "Microsoft's up one and five-eighths." With PocketNet's services, you drive the inquiries, instead of the announcements driving you.

If you want it both ways, you can use the CDPD modem in the phone to make IP connection to the Internet from your notebook. The raw speed of CDPD is 19.2 Kbps. Given the limited transmit time of this and every other cell phone, you've got to want it pretty badly to go this route, but it could be a lifesaver or a deal clincher.

CDPD isn't cheap (is any cellular service?), but it's not unreasonable if you want or need it. My local Regional Bell Operating Company prices it from a barebones minimum of \$15 per month, plus \$.15 per kilobyte of data, to a \$90-per-month rate with only \$.04 per kilobyte.

As I use the PocketNet Phone, I have to remind myself that this is a first-generation device. Although it's heir to years of cellular technology and miniaturization, the next couple of generations will be far more interesting. They'll be smaller and lighter, and they'll have better screens, battery life, and input techniques. A cellular phone isn't the only way to harness CDPD. If data is more important to you than voice, you can get a CDPD modem for your Windows CE device: AT&T showed CDPD links using Motorola modems in Compaq WinCE machines back at Fall Comdex.

CDPD is an interesting service on a slow takeoff. PocketNet might just give it the impetus it needs to fly. □



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Computer Doldrums Coming Fast

There's a fear in the computer business that this industry could soon fall into another sales slump. I've always advocated that people keep up with technology by buying the newest and fastest systems they can afford. But it's hard to make this recommenda-

tion when there is no logical reason to do so. The majority of users today simply cannot utilize the power they already have. More pathetic is the fact that most users need more power only so that Windows can run faster. If Microsoft optimized its software, we wouldn't be stuck on this treadmill, and perhaps some serious new applications would appear.

We are now in a lull. And the Internet exacerbates this situation, since processor speed is of little importance when throughput is limited by a 33.6-Kbps modem connection. All the processor does is decompress a JPEG file or maybe run some Java scripts. This situation will just encourage the purchase of cheap machines once people get a clue (see my column "The Compaq/Cyrix Blockbuster," May 6, 1997).

Right now, I see no reason to recommend anything faster than a midrange Pentium PC. Intel and everyone in the business know that if something doesn't change, the entire industry is in trouble. The something they are hoping for is the emergence of high-performance video applications—the kinds of things that would benefit from MMX systems.

Unfortunately, people have been slow to add video to their computers, and there is no evidence that this is changing. Intel has been promoting video phones for years. In the company's most recent series of commercials, the MMX chip is shown as part of an elaborate video phone system. Truth is, no one is biting. There doesn't seem to be a compelling reason to use video. Not that it is not cool to have—it is. But there isn't the same lure as with sound add-ins.

Game technology has been the driving force behind personal computing. All the cool graphics, the need for color, and the need for sound derive from gaming. Computer games have yet to integrate video into their technology, and this is the reason video has not taken off as was hoped. Furthermore, I don't see how gaming technology can use real-time video cameras in any compelling way.

There are products today that could draw the consumer to video. For example, Hauppauge Digital makes a variety

of TV tuners. The add-in video card has done well, but it hasn't set the world on fire. If people really want to watch TV on their desktops, I believe this product could launch Hauppauge into the stratosphere.

And the modest success of the Connectix Quick Cam camera ball has led Kodak and others into that market with a so-called tethered camera. It's hoped that people will want to use these cameras for snapshots and video phone applications. Behind this technology is the thought that better quality might be what it takes to create a stir. I believe that this market will have only moderate success.

One past example of successful adoption of new technology was the implementation of the mouse. At first, it was only moderately useful, but it soon became a standard part of computing because it seemed futuristic and it was cheap. A tethered camera will also be inexpensive but will need a universal serial bus (USB) port (this is because we're all maxed out on ports and IRQs). The biggest question is whether the tethered camera will require a faster processor. Probably not, but since it requires a USB port, this probably means a new machine for most people. If someone can come up with any sort of software system that makes these cameras practical, then they just may become ubiquitous enough to find a niche.

Even if we all adopt video tomorrow, the business of buying may still slow down at the high end, since people are no longer going from one bloated software system to another. Someday Microsoft and other vendors will have to stop the bloat and give us performance. This will put more pressure on chip makers to slow down. Delays in releasing the Pentium MMX processor show that this may already be happening. But AMD and Cyrix complicate matters by catching up to Intel—meaning Intel is rushing ahead with new designs.

The only hope is for the evolution of a new software concept or application category that requires serious processing power. I'm afraid that with the Internet getting all the attention, it's going to be a long wait.



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I cannot advise people to buy a top-of-the-line machine when there is no reason to do so.

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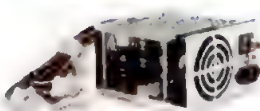
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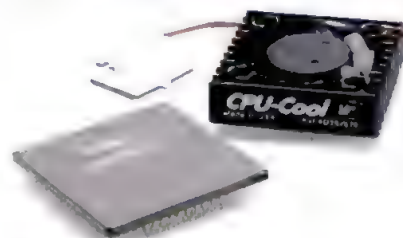
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PENTIUM & 486

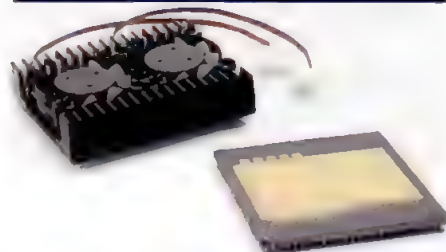


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3-Yr. Fail Rate:	1:100	1:10	1:1,000	1:1,000,000
Height:	1.2"	1"	0.74"	0.74"

CPU-COOL 3.2 \$29

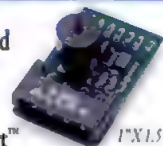
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Inside Track

Golden Anniversary: This year marks the **50th anniversary** of the invention of the transistor at Bell Labs and all it has **wrought**. The wealth of the **mighty** Bill Gates is a direct result of this invention.

We've all come to know how fast our computing power would increase since the day Gordon Moore predicted that transistor count in a circuit would grow exponentially, thereby increasing computing power at the same rate, but that the price would not go up. This has come to be known as **Moore's Law**. The **death** of Moore's law was a major topic at a recent Association for Computing Machinery bash celebrating these years of progress. Many believe this law is going to **crap out** in as little as six years.

Carver Mead, the father of very large-scale integration (VLSI), talked of optical, quantum, and even **DNA computing** as possible new directions when the laws of physics **destroy** silicon-based circuitry. The concept of biological computing is on everyone's mind as the first biological system is being developed. It should compete with photonic machines that people keep trying to build.

Other Chip Developments: Over the years the idea of the silicon hard disk comes and mostly goes. Now comes the **hard disk on a chip**. This device is a 32-pin chip that could store up to 72MB and serve as a hard disk for embedded systems. The first 8MB costs about \$67 in the quantities that system vendors buy. The 72MB chip is designed to boot and run Windows 95. Gee, I hope they don't use it for the local traffic signals. I can't imagine what embedded-system engineer would want to run Windows 95, but who knows? Maybe this would create a new form of **job security**. Contact M-Systems at 408-654-5820.

The "instant news" phenomenon on the Internet is quite interesting. News organizations are using the Net to avoid pressure from publishers and advertisers to hold off on stories that might be **premature**. It's also a great way to get news out faster than the competition, creating a **new scoop mentality** in journalism as newspapers and magazines compete for readers. *The Dallas Morning News* did this with Timothy McVeigh's alleged admission of guilt before a judge could **gag-order it into oblivion**. This ability to publish things instantly is changing the way breaking news is handled.

Too Many Jokes to Tell Dept.: America Online now offers chat-room advertising. When someone mentioned that the chat room dubbed "Depression" was going to be **sponsored by Prozac**, a friend sighed in relief, "At least the room wasn't sponsored by Smith & Wesson."

*The demise of
Moore's Law is fast
becoming an issue
in the industry as
pundits look to
biological and photonic
systems as the
next stage of the
evolution of computing.*

Spam of the Month Dept:

As each of my "secret" mailboxes fills up with various spams (unwanted Internet-delivered direct mail), I'm more amused by the tricks used to get my attention. The best I've seen recently was from someone who complained that such and such a Web site is a **rip-off** because another ISP is giving away free Web sites. "How can they do it? I don't get it. What do you think is going on?" This is followed by a URL that you're encouraged to check out. Nice try. Let's create an **acronym** for the term *spam*. SPAM—Special Personal Attack Message. Send your suggestions to me *clo PC Magazine*.

Macintosh Deathwatch

Dept.: I believe that core Mac users are holding firm and those who

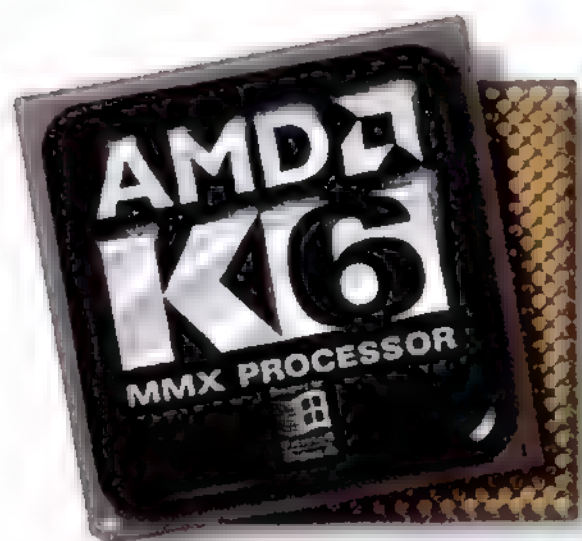
planned to bail out of the platform have already done so. The hard-core Mac aficionados are in it for the **long haul**. Their patience will be rewarded as they may finally get a subnotebook that equals the IBM ThinkPad 560. **IBM plans to manufacture** a notebook for Apple using the technologies that went into the 560. I'm told that the thing may weigh 3.9 pounds. This means the next iteration of the 560 might also be as light.

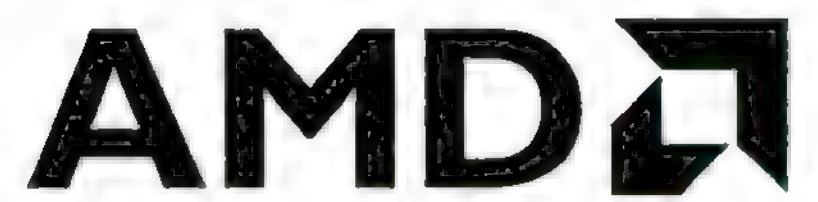
More Dubious DVD News Dept.: As you know I've been watching the DVD scene closely, and the most recent bad turn of events is with regard to recordable CDs. I'm told that most DVD drives, although initially promoted as fully backward-compatible with standard CD-ROM technology, **will not read CD-Rs**. It has something to do with laser frequency. It seems to me that if a \$50 2X junker of a CD-ROM drive can read these disks, then the \$1,000 DVD should also be able to do so. Technology marches on.

Rewriting History Dept.: Marshall Toplansky, former U.S. Robotics executive, now VP of Marketing at Hayes Microcomputer, was interviewed in the newsletter *Mobile Computing* (\$595 per year, 415-390-0930), where he made an interesting comment that begs for a rebuff: "The big mistake Hayes made was listening to the hobbyist segment of mobile users and designing products to meet their needs. This was not where the market growth was."

He goes on to say that cell phone stuff was where the action was. I don't know what **hobbyists** he's talking about, but most so-called hobbyists are very leading-edge—in fact, all wanted cell phone modems. Furthermore, if Hayes had listened to hobbyists, it would have **taken ISDN more seriously**. As things turned out, the ISDN group that worked at Hayes is now the core of Ascend Communications, one of the fastest-growing companies in the world and a leader in, yes, ISDN. Maybe the hobbyists this guy is talking about are old CP/M diehards and guys who rebuild Coleco machines. The comment **mystifies** me. □

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The VBA Revolution: Quiet, Important

I've supervised a number of large-scale software-development efforts. The results have usually been worth the pain, time, and enormous amounts of money involved—or, at least, my consulting clients said they were. But that's not always the case. And I've often

wound up thinking, at the end of these projects, what an inefficient process this is: Assembling a whole from lots of discrete parts, rarely able to reuse existing parts, trying to get lots of new, cranky things to work together in some stable form. And *lots* of time spent arguing about and creating *structure*: The basic chunks of program code that handle the mundane stuff.

Object-oriented programming in general, with its promise of libraries of reusable code, is a good first step towards solving these problems. Learning about classes and inheritances and the rest of OOP is essential for anyone who wants to stay current—and, probably, stay employed.

But standard OOP, while it reduces the time and cost of developing new programs and can make programs more reliable in earlier iterations, still doesn't answer the need for *really* fast development of new business apps. Often, these new apps have strong relationships and resemblances to existing shrink-wrapped apps—becoming, in effect, extensions of them—but they must still be developed laboriously, starting from scratch.

Over the past few years I've become intrigued by the potential of many off-the-shelf "shrinkware" products to be modified and extended into truly useful—and very different—tools. I'm convinced that this approach of using an existing, solid, off-the-shelf product, which can be adapted and modified in many ways through built-in programming tools to produce a "new" custom application, is going to be a big part of our near-term future in business computing.

Starting a development project with a true, shrink-wrapped, off-the-shelf product is a very different approach, with different economics and time lines, than traditional program development. It's also one in which non-programmers can participate much more fully than when they just sit down in a conference room with a blank sheet of paper and a couple of programmers to begin designing a true custom app. This way, the customers/users/managers behind the notion that new products can show the programmers something on-screen that's much more like the

finished result, simply by using the application itself. The programmers can then use the tools within the product to produce a first iteration that has been, in my recent experience, often remarkably close to the final code.

Among the best examples of ready-to-extend products are Visio's new releases of its Visio Technical and Visio Professional packages. I've loved Visio from the first day, years ago, when I unpacked an early beta copy and found a drawing program for people like me, who can't draw.

Visio makes this possible by using a graphical analogy to old-time drawing-board work: Green stencils, just like the green plastic stencils we used to overlay on drawing paper to trace rectangles and squares and circles. Visio's "SmartShape" electronic stencils, organized together into related templates, are far more useful than those thin pieces of green plastic, of course: They "know" about shapes, and in combination with Visio's other drawing tools let you produce a remarkably good drawing of a floor plan, organization chart, process chart, or almost any other sort of business-related graphic.

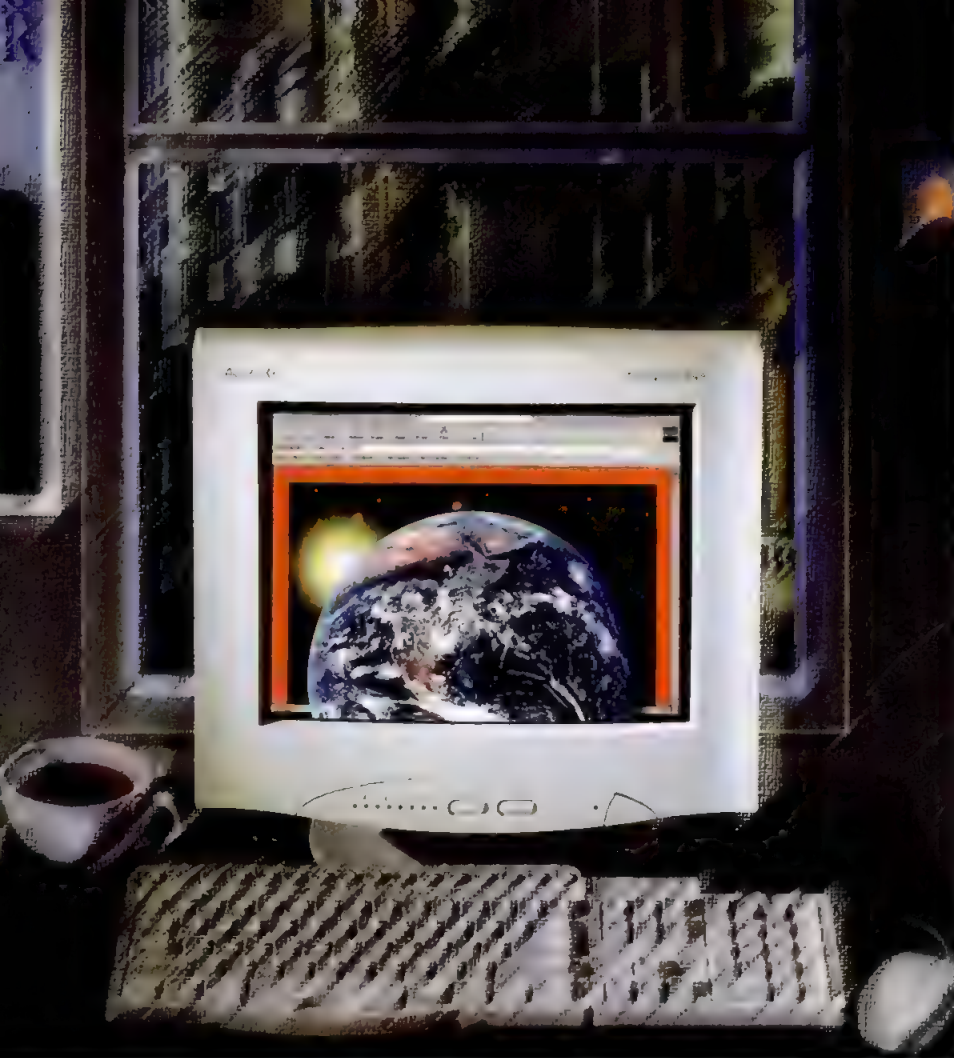
With this new release, though, Visio becomes a lot more than just a very good shrink-wrapped app. Now, with Microsoft Visual Basic for Applications in the product, you can create standalone apps from Visio Technical and Professional that use Visio as, in effect, a graphics engine. They can work and look very good indeed—depending on the skill of the

VB programmer—and can be put together remarkably quickly and inexpensively. These finished VBA'd Visio-based apps can be distributed as standard Visio .VSD, .VSS, and .VST files. The Visual Basic code is embedded in those files. (Users of these finished programs still have to have a copy of Visio on their PCs, of course, to run the programs. Sorry, no free lunch.)

For years, businesses have been using Visio for tasks that range far from the usual drawing-board stuff—for example, giving it to field engineers and salespeople to use on-site in customers' offices and plants for creating layouts of proposed HVAC designs, LAN diagrams, or cubicle



NOT ENOUGH
Object-oriented
programming
doesn't answer
the need for
fast development
cycles.



JIM SEYMOUR

arrangements. But this VBA facility goes way beyond that.

Microsoft has done a good job with Visual Basic on both the development and marketing sides. Visual Basic has become a lot more than the Common Man's Programming Language. It's a serious development environment now, and with VBA, Microsoft and its partners can deliver a complete development environment *inside an app*—offering a way of creating serious, customized applications without writing the truly hard stuff, and without resorting to an external toolkit.

I know a lot of very good VB programmers. They've been bending my ear about this built-in VBA notion for some time and now are starting to show me apps they've created with it. I'm impressed. I like what I see on-screen, and I like even better the one- to three-week development schedules they've been telling me about.

If you're interested in turning out customized, graphics-based apps, you could do a lot worse than to take a look at Visio 4.5. If you're not a skilled Visual Basic programmer—and as always, the skill of the programmer is always the key, since this isn't trivial stuff—get someone who is skilled to help you in your evaluation. I think you'll be surprised and delighted with the results.

Look, too, for other apps appearing with VBA. There's a lot of interest in this idea of extensible shrink-wrapped apps, especially among corporate developers who live with project deadlines that would terrify the rest of us. I don't envision people creating commercial apps for resale with a combination of Visio and VBA, but I do see a lot of in-house development work migrating to this model.

However, keep in mind that not every programming job—in fact, not nearly a majority of programming jobs—are candidates for this kind of embedded VBA work. Many projects require far bigger and more complex program designs; they need the skills and tools available in, for example, the C++ world.

I say this not because of a lack of faith in what can be done in Visual Basic, but because every time some new "program generator" has come along—a phrase, please note, that you've never heard from me—innocent folks get suckered into thinking that programming is no longer necessary, that end users can create anything with that latest wonder package.

VBA's not that miracle, and neither is Visio 4.5. But they are very good programmer helpers, and that's valuable, too. And worth a look. □

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Making Order Out of E-Mail Chaos

The Autobahn works so well because motorists observe common rules and courtesies—like staying out of the left lane when they aren't passing—and that allows for faster, more efficient travel. I only wish we could bring a similar sense of order to electronic mail.

Many of us are awash in e-mail. I get 50 to 100 messages a day, amounting to 15MB to 20MB a month. There's no question that e-mail helps us be more efficient. But the misuse of e-mail can hurt. Here are some thoughts on using e-mail effectively—so you're more productive, so you're not bothered by dolts, and so you're not the dolt bothering the rest of us. Bear in mind that within companies using a lot of e-mail, people higher up the corporate food chain—that is, the ones who sign off on your proposals and on your annual reviews—are probably getting a lot of e-mail. You want to cut through the clutter without annoying them.

Good e-mail starts with a useful subject line and a short message. The subject line should make sense to both the sender and the recipient. For instance, a lot of vendors want to come show us PCs and printers and Internet utilities, and their PR people dutifully send e-mails with the subject line "Meeting" or "Meeting with PC Magazine." Makes perfect sense to them. Better XYZ Corp.'s message should say "XYZ-PC Mag meeting week of 5/26?"

Short messages are better, even—especially—the important ones. Keep them so the message and header fit on one VGA screen.

The Internet dutifully reduces most e-mail to a single font, for which I'm grateful when I see internal e-mail with multiple fonts, colors, and—all too often—clip art. How can you claim to have a lean organization when the annual notice-of-carpet-shampooing memo includes multiple fonts, colors, and clip art of a guy in a blue, zip-up service jacket who looks the Maytag repairman? I fear the day when embedded animation comes to e-mail.

Some users send such highly formatted messages as e-mail attachments, which immensely slows down the reader. I recently got a 440K press release from a PR person who violated virtually every rule in the book—overly long message, with clip art, sent using Word for Windows 97 (very few users have upgraded from earlier versions). The only dumb thing that he didn't do was save the message as a single-font, ASCII-text-only message with hard carriage returns ending

every line, and then saving that as an attachment.

There should be a special place in e-mail purgatory for people who send messages longer than "OKAY" in all caps. Conversely, the e.e. cummings school of all-lowercase typing doesn't bother me, perhaps because it's been used in

publishing to distinguish memos or notes from manuscript meant for typesetting. I've come to accept the parenthetical <g> because a lot of people don't get it when a thought is tongue-in-cheek. But not everyone likes getting smiley faces, especially when the memo is going to someone older than Gen X.

Color can be useful in moderation when you add your thoughts as annotations to someone else's memo. You can also use boldface or all caps (I admit I do it myself sometimes, if it's a short addition).

Opinion varies over whether to embed the previous thread of memos in your response. It does make your memo longer, and if you include five previous notes but leave out a sixth, the sixth person will wonder if that was a deliberate move. But, by the same token, there's a good chance that the other recipients discarded the previous messages or can't find them in the clutter of their mailboxes. If you're responding to just one point of a long memo, clip and paste the pertinent paragraph only. There's an evolving convention that >>> inserted before text means "you wrote," and <<< inserted before text means "I write." Best bet is to lobby your company to upgrade to e-mail systems that do auto-

threading of messages (Lotus Notes 4.x, for instance).

Unless the matter is really urgent, don't respond too quickly. People who respond to every message within 5 or 10 minutes probably are paying more attention to their e-mail than their job. Stifle the urge to mark mail Priority or Urgent and use the Receipt function only if you're trying to reach someone and genuinely need to know whether he or she got the message.

A hasty reply can also be dangerous because you may be too passionate, forceful, or hostile. Let the draft response cool off for an hour before sending it. Use that time to grab a coffee and run the spell-checker. □



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AcerView 56e	15" (13.7 Viewable Image Size)	1280x1024 @62Hz	Digital Control	.28mm
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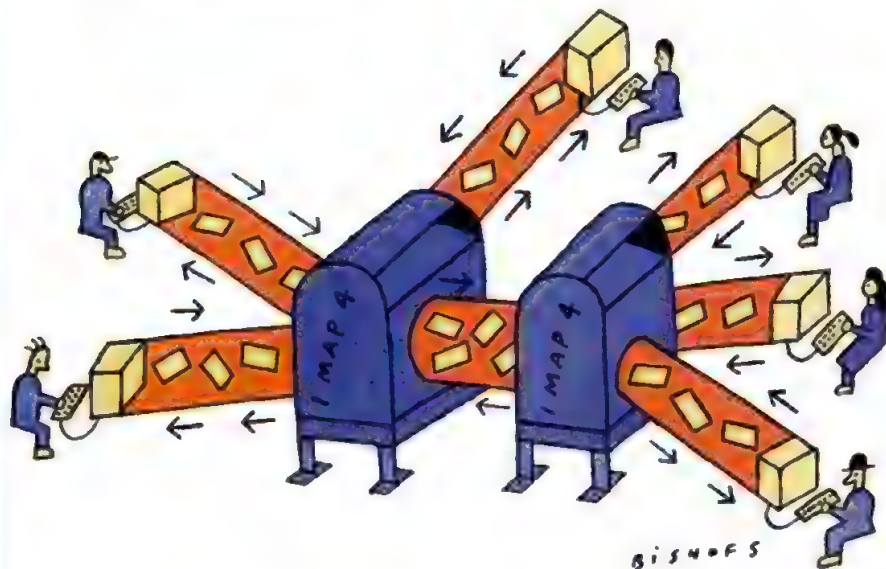
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NETWORK EDITION

IMAP4 SERVERS

Behind the IMAP Rap

The first round of IMAP4 servers has hit the market, offering functionality that was previously reserved for proprietary e-mail systems.



By Padraic Boyle

Up to this point, deciding what kind of e-mail system you wanted to implement was a sticky choice. Did you want the openness that a standards-based system offered or the functionality and features of a proprietary system. Thanks to Internet Message Access Protocol4, or IMAP4, the choice is about to get easier. Until now, going with an open e-mail standard meant installing a Post Office Protocol3 (POP3) mail server. Though unquestionably open, POP3 is a basic store-and-forward e-mail system. For such goodies as shared folders, the ability to work off-line, and the option to download only selected attachments, you had to choose a

INSIDE



You've heard a lot about the new Internet e-mail standard called IMAP4 and how it will bring the power of standards-based messaging closer to the level of robust proprietary messaging packages such as Lotus Notes and Microsoft Exchange. Well, as soon as we heard about the first round of real IMAP4-compliant products, we made sure we got our hands on them and put them through their paces.

IMAP4 IS OFF TO A PROMISING START, according to contributing editor Padraic Boyle. He set up and configured four new IMAP4 servers from AltaVista, Fujitsu, Netscape, and Sun for this Network Edition cover story. Padraic made sure he tested all the servers with several of the available IMAP4 clients on the market. Though all the servers did not support all facets of the IMAP4 standard, they came close. Surprisingly, it was the clients that showed the most variation in IMAP4 support.

SNA AND TCP/IP NETWORKS don't have to live separately. If you've been looking for ways to combine your SNA and TCP/IP networks, check out this Network Edition First Looks section. Contributing editor Steve Rigney tested two LAN-to-mainframe connectivity products: Eicon's Aviva Mainframe Edition and WRQ's Reflection Suite for the Enterprise. (Page NE20.)

NETWARE AND WINDOWS NT may be even more perfect together with Novell's introduction of Workstation Manager, also reviewed by Steve Rigney. Project leader Jeffrey Witt evaluates a Web server appliance for small businesses and workgroups. (Page NE19.) And Steve Buehler, director of PC Labs, West Coast, discusses telecommuting in Iowa in Multiple Access. (Page NE26.)

—Leon Erlanger

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proprietary e-mail system, such as the prototypical Lotus Notes. And if, for example, you wanted your Lotus Notes server to talk to a cc:Mail server, you had to invest in an e-mail gateway, which basically served as a translation engine. (Lotus Development Corp. is beginning to address the issue of open standards with Domino; see our groupware story, "Multiple Personalities," in this issue for more information.) IMAP4 gives you another option.

IMAP4 lets anyone using an IMAP4 mail client on any operating system read and reply to messages, store mail in hierarchical folders remotely, and synchronize client files with the IMAP4 mail host. The clients and the server operate together, allowing you to filter mail from specific addresses and to prevent large files from being downloaded over a slow dial-up link. Users can view mail messages on the host and decide what—if anything—they want to download to a remotely connected client. They can also download messages selectively without having to download the attachments.

In this Network Edition roundup, we evaluate four e-mail servers that conform to the new IMAP4 standard: AltaVista Internet Software's AltaVista Mail Server 97, Version 2.0; Netscape Communications Corp.'s Netscape Mail Server 2.02; Fujitsu Software Corp.'s TeamWare Intranet Mail 5.1; and Sun Microsystems' Solstice Internet Mail Server v2.0. Each of them supports the IMAP4 standard as well as the older POP3. With the exception of the Solstice Internet Mail Server, which requires Sun's operating system, Solaris, and an Intel or SPARCstation platform, all the products run on Intel or Digital's Alpha computers running Microsoft Windows NT. Netscape Mail Server works with Solaris as well.

In general, these mail servers work well as Windows NT Server applications and hold no surprises. The differences are in their administrative utilities.

IMAP THE FOURTH

Developed at Stanford University in 1986, IMAP is an open standard designed as a superset of the deeply entrenched POP open mail standard. The most recent evolution of the standard is IMAP, Version 4 Revision 1 (rfc 2060). The only real difference between IMAP4, Revision 1, and IMAP4, however, is improved performance over dial-up links. For more information on the IMAP4 standard, check out the University of Washington's IMAP information page (www.washington.edu/imap/). Though the swell of support for IMAP and its features hasn't yet overwhelmed POP3 in everyday

Editors' Choice

• Solstice Internet Mail Server



The IMAP4 game is definitely in the first inning. All the products we reviewed handle most features of the standard on the server side nicely, but their

handling of the client side was lacking in refinement and interoperability. Each IMAP4 solution had its pluses and minuses, but Sun Microsystems' Solstice Internet Mail Server v2.0 scored the first run in the IMAP4 market in terms of both the server and the client.

Solstice, which, at \$495 (list) per server was the most inexpensive of the products we reviewed, supports all three IMAP4 modes—online, off-line, and disconnected—as well as shared folders and the ability to selectively download text and attachments. In addition, Sun offers its Solstice Internet Mail Client (SIMC) for free. Though not equipped with the most elegant of interfaces, SIMC is the only client that connected to all the IMAP4

servers we tested without a hitch. And it supports online, off-line, and disconnected mode with any IMAP4 server. The other clients we tested didn't work in disconnected mode with all servers. But Solstice doesn't yet have an administrative client, and if you're not currently running Unix, Solstice will require an investment in a SPARC- or Intel-based platform running Solaris 2.4 or greater and a person on staff with Unix expertise.

Our honorable mention goes to Netscape Mail Server 2.02, the best of the Windows NT bunch we examined. You can purchase Mail Server as a standalone product or as part of Suite Spot. Like Solstice, it supports IMAP4 well on the server side but doesn't offer a foolproof client yet.

use, the path for growth is clear. The vendors of the major groupware products all plan to include IMAP4 support (see "Multiple Personalities" in this issue).

By definition, POP3 is a store-and-forward messaging system. A POP3 mail server sends a client its messages and doesn't keep a copy on the server. IMAP4, on the other hand, is a client/server application. In both cases, incoming mail is stored on a centrally located mail server. Using a protocol-compliant mail client, users connect to the mail server. An authentication process validates log-on names and passwords before granting access to mailboxes. But that's where the similarities end.

Unlike POP3, IMAP4 can interact with clients in three modes or messaging paradigms: off-line, online, and disconnected. In addition, IMAP4 gives users access to multiple private and shared mailboxes.

Clients operating in off-line mode store their mailboxes on their local hard disks for reading and creating messages. The user connects to the server to send and receive messages. Off-line mode is often used by road warriors who rarely stay in one place. POP3 typically operates in the off-line mode.

By contrast, online users access mailboxes that remain on the mail server but are still manipulated by clients. The mail doesn't leave the server's storage. Online mode is mainly used by stationary users, particularly across a fast LAN connection, but it also works well with low-powered computers dialing in from remote locations. Some POP3 servers offer online capabilities but not at the same level as IMAP4 does.

Disconnected mode offers the most flexibility. The client software copies, or caches, messages and attachments selected by the user to a local disk and leaves the original copy on the mail server. The messages in cache can be manipulated and later re-synchronized with the mail server after reconnecting. At present, this feature is implemented on mail server programs, but few clients available today support disconnected mode. Of the products in our roundup, Sun's Internet Mail Client was the only one that offered this capability.

IMAP4 is expected to team up with another Internet standard called ACAP (Application Configuration Access Protocol), designed at Carnegie Mellon University. An ACAP-compliant client lets you access mul-

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multiple IMAP4, Revision 1 mailboxes on multiple servers. ACAP stores information regarding the location of mailboxes, address books, and bulletin boards. ACAP is intended to work with, not compete against the Lightweight Directory Access Protocol (LDAP). Future versions of IMAP servers will most likely implement both standards.

HANDS ON

On our test-bed, we ran the IMAP4 e-mail servers on a Windows NT-based server, except for the Sun product, which we ran on a SPARCstation2. We tested all the servers using Siren Software's Siren Mail, Esys Corporation's Simeon Mail, and the University of Washington's PCPine mail clients. We tested cross-product functionality using Sun and TeamWare mail clients.

During our tests, we simulated sending and receiving small and large messages; some messages included file attachments. We also tested each server's ability to work in off-line, online, and disconnected mode.

When ordering server hardware, figure on approximately 20MB to 40MB of disk space for each user and order plenty of RAM. Because many of the files swap in and out of memory, these mail systems need a large pool of memory. The general amount of RAM needed in the server depends more on the amount of simultaneous multiuser activity than anything else.

On our tests, we looked at how each mail server implements the IMAP4 standard and how the server interacts with various IMAP4 clients. The testing showed up the limited number of IMAP4 clients on the market today. Even though each server was IMAP4-compliant, the clients were the limiting factor when it came to exploiting the features of IMAP4 fully, particularly disconnected mode.

Despite claims about open protocols, some client software had more features when used with server software from the same company.

SECURITY

IMAP servers primarily use the standard name and password system to grant a user access to mail files. One of the extensions to the IMAP standard is Access Control List (ACL), which can grant access based on IP address. Although none of the mail servers we reviewed include IMAP4's ACLs, the

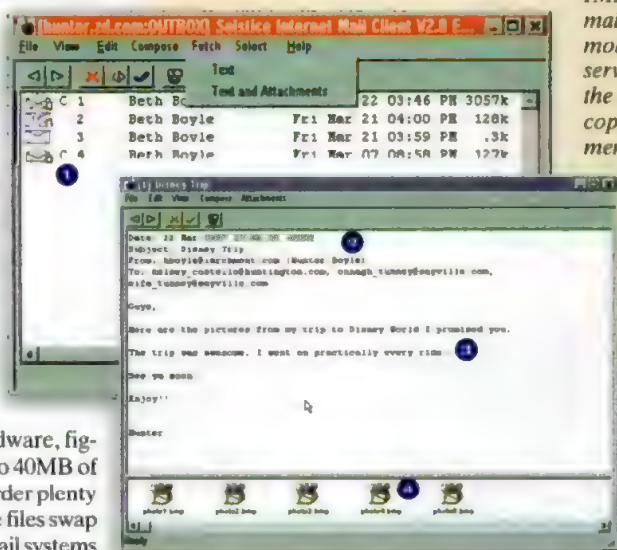
1 The IMAP4 standard follows a client/server model. The mail messages sit on the mail server until your users decide to download the mail messages and attachments. The POP3 standard is purely store-and-forward. Mail messages are sent down to users automatically when they log onto the server and then the messages are deleted from the server. From any IMAP4 client, users can view their mail messages by sender, subject, and size. Then, they can then fetch the

individual messages they want as well as the attachments.

2 The message header in IMAP4 clients is standard; it includes the date, subject, and recipients.

3 Part of the beauty of IMAP4 is the ability to operate in off-line, online, and disconnected modes. Off-line is a great option for people on the road. Users store their mailboxes on their local hard disks and connect to the IMAP4 server only to send and receive mail. Users operating in the online mode access a mailbox on the mail server. But disconnected mode offers the most flexibility. The client caches copies of your messages and attachments, which can be manipulated and later synchronized with the copies on the mail server.

4 Built into the IMAP4 standard is the ability to view attachments and download only the ones that you want.



Netscape Mail Server and TeamWare Intranet Mail offer proprietary methods of limiting access based on domain name. In addition, Netscape's product can use the company's SSL (Secure Socket Links) when administering the server through a browser.

Only TeamWare Intranet Mail offers an add-on package for mail clients to add cryptography over the Internet. Another form of encryption is secure MIME, or S/MIME. S/MIME, an RSA-based data-encryption scheme, has become the de facto industry standard; it allows users to add digital signatures to messages sent across the Internet. These digitized messages are encrypted from end to end. The drawback with S/MIME, however, is that it disregards one of the main features of IMAP4: the ability to separate text from file attachments.

CLIENT CRUNCH

Pioneers endure hardships, and the early users of IMAP4 will face an available-mail-client drought. During our testing of these mail servers, we ran into some difficulty mixing mail clients with different

IMAP4 servers. Netscape Mail Server, for example, couldn't separate attached files from the text and header portions of messages—one of the most useful features of IMAP4—when using the Simeon mail client. It could, however, accomplish the task with the Siren mail client, but Siren doesn't work in disconnected mode. Netscape Communicator, available only in beta version at press time, comes with a built-in mail client, which is advertised as being fully compatible with IMAP4, but we were unable to get the software working. Only the Sun client supports all IMAP4 functionality. The others lack support for either hierarchical folders or disconnected mode.

Should you consider moving to IMAP4 now? We think that most potential users of IMAP4 will want to set up a test server first, and this is certainly the right time to do it. In the next few months, the Internet-active companies will deliver more IMAP4 clients, and the major groupware vendors will embrace IMAP4 more fully. If you feel more comfortable with POP3 but plan on moving to IMAP4 in the future, then any one of these mail servers will accommodate the change. Each of them offers support for both protocols on the same server. Keep in mind, however, that although vendors support upgrading POP3 users to IMAP4, they don't support changing them back.

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SUMMARY OF FEATURES

IMAP4 Mail Servers

PC MAGAZINE
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EDITORS' CHOICE

■ YES ■ NO □ OPTIONAL

Products listed in alphabetical order

List price for 1,000 users

AltaVista Mail
Server 97Netscape Mail
Server 2.02Solstice
Internet Mail
Server 2.0TeamWare
Intranet Mail 5.1

Platforms Supported

Windows NT

Solaris

Alpha, Intel

None

Alpha, Intel

Sparc

None

Sparc

Alpha, Intel

None

IMAP4 Clients Included or Available

Windows 3.x/95/NT

Macintosh/Unix

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IMAP4 Features Supported

Off-line/Online/Disconnected

Append messages to/manage remote folders

Multiple/hierarchical folders

Shared address book/folders

IMAP4 and POP3 on the same server

Server-based searching

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Protocols Supported on Server

IMAP4: RFC 1730/IMAP4: RFC 2060

MIME, S/MIME, POP3

SMTP/Finger

LDAP

X.400

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Other

ACL/Annotate/Quota

Web-/Windows-based administration

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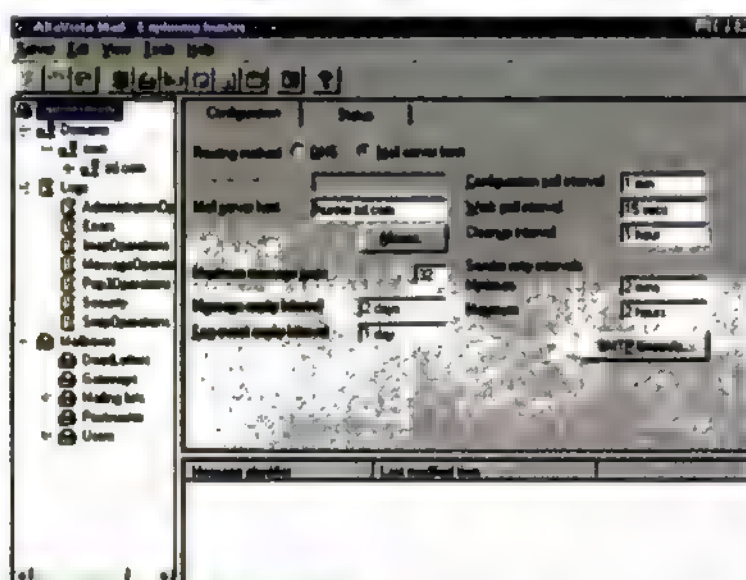
AltaVista Internet Software

AltaVista Mail Server 97

If you're looking for an easy-to-setup, easy-to-administer mail server, take a look at AltaVista Internet Software's AltaVista Mail Server 97. Of the products we reviewed, AltaVista Mail provided the best out-of-the-box experience. And at \$495 for 250 users and \$3,995 for unlimited users, AltaVista's is the most aggressively priced product in our roundup—except for Sun's Unix-based Solstice Mail Server. Unlike the Solstice Mail Server and TeamWare Intranet Mail, however, AltaVista Mail Server doesn't offer a mail client. We tried it with all six IMAP4 clients used on our tests, though, and we were able to communicate with no problems. Still, AltaVista Mail does lack some bells and whistles, such as shared folders and the automated replies found in Netscape Mail Server and TeamWare Intranet Mail.

In addition to its ease of use, AltaVista Mail has a couple of other advantages. It's part of a line of Alta-

Vista products, which includes AltaVista Forum for Web-based collaboration (see "Pure Intranets" in this issue's groupware story, "Multiple Personalities") and AltaVista Directory for directory services. This means you can use AltaVista Directory in conjunction with AltaVista Mail to add directory services to the mail server. AltaVista Mail is also the only mail server in our roundup that supports IMAP4, Revision 1, the latest incarnation of IMAP from the Internet Engineering Task Force.



PAINLESS INSTALLATION: AltaVista Mail Server 97's wizards provide a quick and easy setup.

In case you want to tie together your Internet and LAN-based e-mail systems—specifically Lotus cc:Mail or Microsoft Mail—AltaVista ships AltaVista Mail Internet extensions—combinations of AltaVista Mail Server and a gateway for either cc:Mail or MS Mail. Like a gateway host, these extensions let you link users on a LAN-based mail system to users on the IMAP4 server seamlessly. As for disadvantages, AltaVista was the only product we reviewed that doesn't support shared folders.

AltaVista Mail Server has handy wizards that walk you through the installation process. And after you've finished installing and configuring the server, the software runs a test to ensure that the mail server is operating properly. This helps you determine quickly whether all settings are correct and operational. If problems with AltaVista Mail Server arise later, you can rerun the test as a troubleshooter.

AltaVista Mail Server's administration utility can be accessed three ways: from a Microsoft Windows-based utility with a Windows 95 Explorer-like front end; from a task menu; and from a Web browser. Any of these options lets you create users and mailing lists, change passwords, and forward mail. As with installation, a series of wizards walk you through each step of adding users, and creating lists and shared mailboxes. In an effort to simplify the administration functions, however, AltaVista Mail Server sacrifices some of the features found in the other products in our roundup. For example, you can't enter finger or contact information.

Nonetheless, AltaVista Mail's administration was the easiest of the products' to navigate. In addition to letting you easily add users and lists, AltaVista Mail keeps extensive logs that record mail server operations and errors.

AltaVista Mail Server 97. List price: For 250 users, \$495; for unlimited users, \$3,995. AltaVista Internet Software, Littleton, MA; 800-336-7890, 508-486-2308; fax 508-486-2017; altavista.software.digital.com. Circle 951 on reader service card.

Netscape Communications Corp.

Netscape Mail Server 2.02

If you're already running components of Netscape's SuiteSpot, then Netscape Mail Server 2.02 (\$995 for 100 users) is a solid choice, primarily because you can manage all your servers from one interface. Netscape Mail Server is available as a standalone product or as part of SuiteSpot. (For a full review of SuiteSpot, see this issue's groupware story, "Multiple



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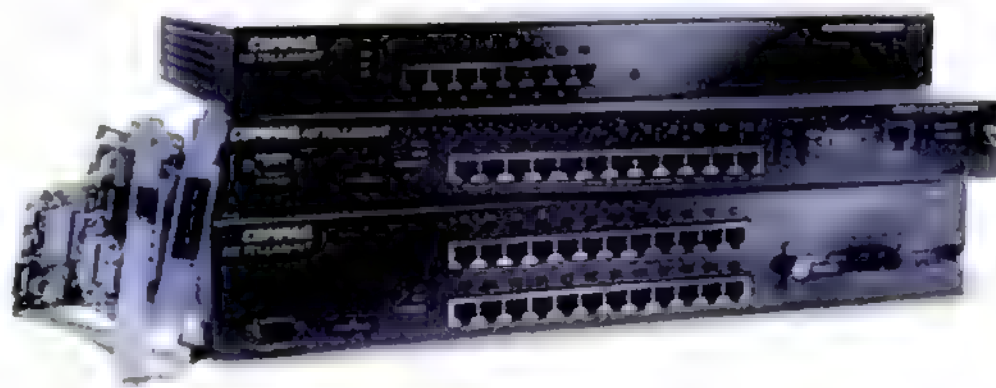
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Personalities.") Netscape Mail Server runs on both Windows NT and Unix and is targeted primarily at medium-size and larger businesses. At this point, Netscape Mail Server doesn't come with a client. As with AltaVista, it worked with all of the IMAP clients we tested, except that with the Simeon client it couldn't separate attachments from text and headers.

Pleased as we were with the overall functionality of Netscape Mail Server, we recommend that you wait for the next iteration, Messaging Server 3.0, which should be available for Unix by the time you read this and for Windows NT by midsummer. Messaging Server will have built-in support for Lightweight Directory Access Protocol (LDAP), SMTP, SNMP, and SSL. The current version of Netscape Mail Server—like AltaVista

Mail Server's administration has several log files—similar in number to TeamWare's—that are great for diagnosing bottlenecks or halted-mail problems. You can view the contents of the queue, and delete and restore jobs. Additional information about the size of mail messages and their time stamps is also available.

Similar to TeamWare, Netscape Mail Server lets users change their own passwords using any Web browser. Users can also activate the automatic message-reply feature—with customized messages—for when they're out of the office.

Because Netscape Mail Server doesn't come with its own IMAP4 client, you have to use the mail reader in Netscape Navigator or a third-party mail client. The current version of Navigator supports only POP3, but Netscape plans to include IMAP4 and POP3 in a new e-mail client—Messenger—which will be part of the Netscape Communicator suite due out by the time you read this. We attempted to get a brief look at this support by downloading the beta version of Communicator, but it initially froze up our workstation, and then we couldn't get it to work properly. The second time we downloaded it, it worked fine. Netscape is

aware of the problem and says it will be fixed by the time the product ships.

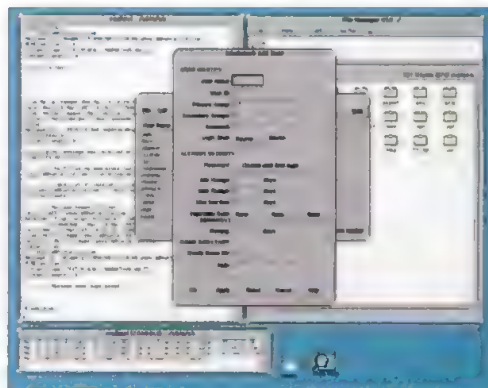
Netscape Mail Server 2.02. List price: For 100 users, \$995. Netscape Communications Corp., Mountain View, CA; 415-937-2555; fax, 415-528-4124; home.netscape.com. Circle 952 on reader service card.

Sun Microsystems Inc.

Solstice Internet Mail Server v2.0



If you work for a large corporation or an Internet service provider that's looking for a robust, aggressively priced IMAP4 mail solution, consider Sun Microsystems' Solstice Internet Mail Server v2.0 (\$495 per server). Of the products we reviewed, Solstice—in combination with Sun's freeware IMAP4 client, Solstice Internet Mail Client (SIMC)—is the most complete IMAP4 solution. SIMC worked perfectly with the other IMAP



HERE COMES THE SUN: Solstice Internet Mail Server v2.0 provides the most complete IMAP4 solution.

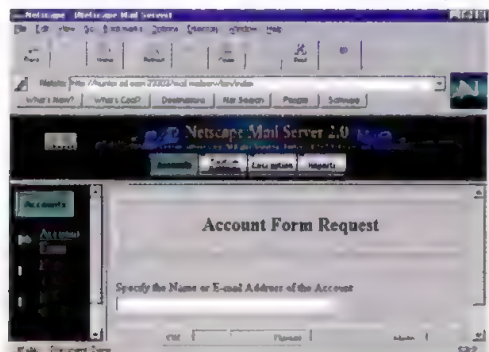
servers in our roundup, and it was the only client that fully supported IMAP4's disconnected mode and hierarchical folders with all the IMAP servers. Like the other products we reviewed, Solstice supports both IMAP4 and POP3 users simultaneously, and it's the only product in our roundup that supports the Unix legacy e-mail system, /var/mail.

Solstice does, however, have a couple of drawbacks. It is the only product we looked at that doesn't have an administrative client; Sun says that the next version will include a Java-based administration utility. In case you want to try Solstice, Sun offers a free trial version along with SIMC that you can download from its Web page.

Unlike the other mail servers in this roundup, Solstice doesn't run on a Microsoft Windows NT platform. It was designed primarily for large corporate environments and requires a SPARC- or Intel-based platform running Solaris 2.4 or later. This requirement, coupled with the need for a Unix-savvy support staff, may put Solstice out of reach for smaller businesses.

Installing Solstice was fairly simple. We added the package as an upgrade through a typical Unix command. Because Solstice doesn't come with a separate administration client, managing the mail accounts and adding and deleting users or groups are done at the command line. This leaves the administrator without an easy way to monitor mail usage, view logs, or manage the mail queue. AltaVista Mail Server, Netscape Mail Server, and TeamWare Intranet Mail all have straightforward graphical administration utilities.

Sun's implementation of the IMAP4 standard was the best of all the products in our roundup, but like the other products, Solstice doesn't support the IMAP4 extensions; there is no support for ACL, an-



FAMILIAR FACE: Netscape Mail Server 2.02 uses a Web-based interface, like all Netscape products.

Mail Server—offers LDAP support through an add-on, in this case Netscape Directory Server. Messaging Server will also comply with IMAP4, Revision 1, and offer such features as Quotas.

For mail delivered to multiple addressees, Messaging Server will store a single copy of the message instead of a copy for each recipient. Sun also plans to offer this functionality in its next release of Solstice Mail Server.

Keeping within Web standards, setup and configuration of Netscape Mail Server use Netscape's Web-based administration interface. Common across all Netscape products, the HTML interface is easy to use and navigate. But because of the overuse of frames on the pages, we were left with little work space, and we couldn't view forms in their entirety. In addition, we found ourselves able to edit or view only one or two fields at a time on some pages. Unlike AltaVista Mail Server, Netscape Mail Server doesn't have any administration or configuration wizards.

Besides letting you add users, Netscape

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notated, and quota extensions. None of the other products we reviewed—with the exception of TeamWare Mail Server—support these extensions, and it supports them only through its proprietary client and server. Folder sharing isn't Solstice's strong suit either. To create shared folders, the administrator must use Unix commands and then assign rights to the appropriate users.

SIMC—which is available for Windows 3.x, Windows 95, Windows NT, and Solaris—represents one of Solstice's strengths. It handled IMAP features extremely well with all the IMAP servers, which wasn't the case with the other clients we tested. For example, SIMC is the only client that supports disconnected mode; TeamWare supports disconnected mode but only between the TeamWare server and its proprietary client.

Even though it was the most robust client we saw, SIMC wasn't the easiest to navigate, and creating new folders requires

a few more key strokes than it does with TeamWare's Embla client.

Solstice Internet Mail Server v2.0. List price: \$495 per server. Sun Microsystems, Mountain View, CA; 800-873-7869, 415-781-8140; www.sun.com/solstice. Circle 953 on reader service card.

Fujitsu Software Corp.

TeamWare Intranet Mail 5.1

Though TeamWare Intranet Mail 5.1 has a strong server implementation and a rich front-end client, it was the most expensive solution (\$590 for 5 users; \$590 for each additional 10 users) in this round-up, and it requires a separate purchase of SendMail and DNS on WIN NT, an SMTP service (\$590). TeamWare Intranet Mail comes with its own IMAP4 client, Embla 2.0. The mail server portion of TeamWare Intranet Mail is also available as part of a

groupware package called TeamWare Office and runs on Microsoft Windows NT; Embla is available on Window 3.11, Windows 95, and Windows NT. A Unix release of TeamWare Intranet Mail is planned for later this year.

When we installed TeamWare Intranet Mail, we ran across an interesting bug in the software. After installation, we couldn't get our server up and running. TeamWare's technical support staff told us to uninstall the product and reset the time zone on our Windows NT server to one hour before GMT. TeamWare said the bug was limited to the early releases of the software and that it will be fixed in subsequent releases. After we got the bug fixed, we had no problem installing the product. Like AltaVista Mail Server, TeamWare Intranet Mail has several helpful installation wizards.

Unlike with the other products, TeamWare Intranet Mail's administration utility is not part of the server installation and

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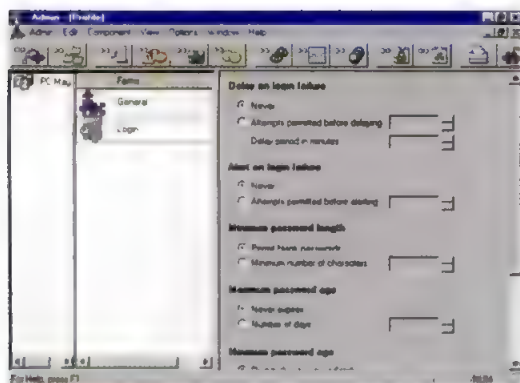


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GET THE WORD OUT: TeamWare Intranet Mail 5.1 lets administrators send messages to users at log-on.

requires an additional step. But once installed, the Windows-based utility was one of the easiest to use and navigate. Its toolbar provided a few shortcut icons, but they were difficult to recognize, and we quickly retreated to the pull-down menus for the rest of our testing. The utility can be ex-

cuted directly on the mail server or—after you provide the proper access authentication—from a remote location.

Creating users in TeamWare Intranet Mail was a breeze. The administrator uses templates—which are great for adding large numbers of users to the mail server—to create users with similar attributes. For example, if everyone in the sales department has the same mail setting and requires access to a shared mailbox, the administrator simply creates a Sales template, eliminating the

need to input information for each user.

Other features of the administration utility let you view system events and statistics, which helps you diagnose your mail server's health. You can also tweak individual server profiles to decide which global information to log or to customize

an individual mail server. A handy house-keeping feature of TeamWare Intranet Mail is the administrator's ability to send messages to all users during their log-ons. For example, you can let your users know that the server is going down for maintenance at 3:00 P.M. Messages can be delivered automatically when users log on, or manually at a specified time or after an alert has been sent.

Embla 2.0, the mail client, is a robust application with all the bells and whistles you need in a mail front end. It lets you send and receive mail, work off-line, modify users' toolbars, change fonts, and create your own mailbox views. Similar to Netscape, TeamWare allows users to change their own passwords easily.

TeamWare Intranet Mail 5.1. List price: For 5 users, \$590; each additional 10 users, \$590. Fujitsu Software Corp., San Jose, CA; 888-248-9273, 408-432-1300; fax, 408-456-7979; www.teamware.us.com. *Circle 954 on reader service card.*



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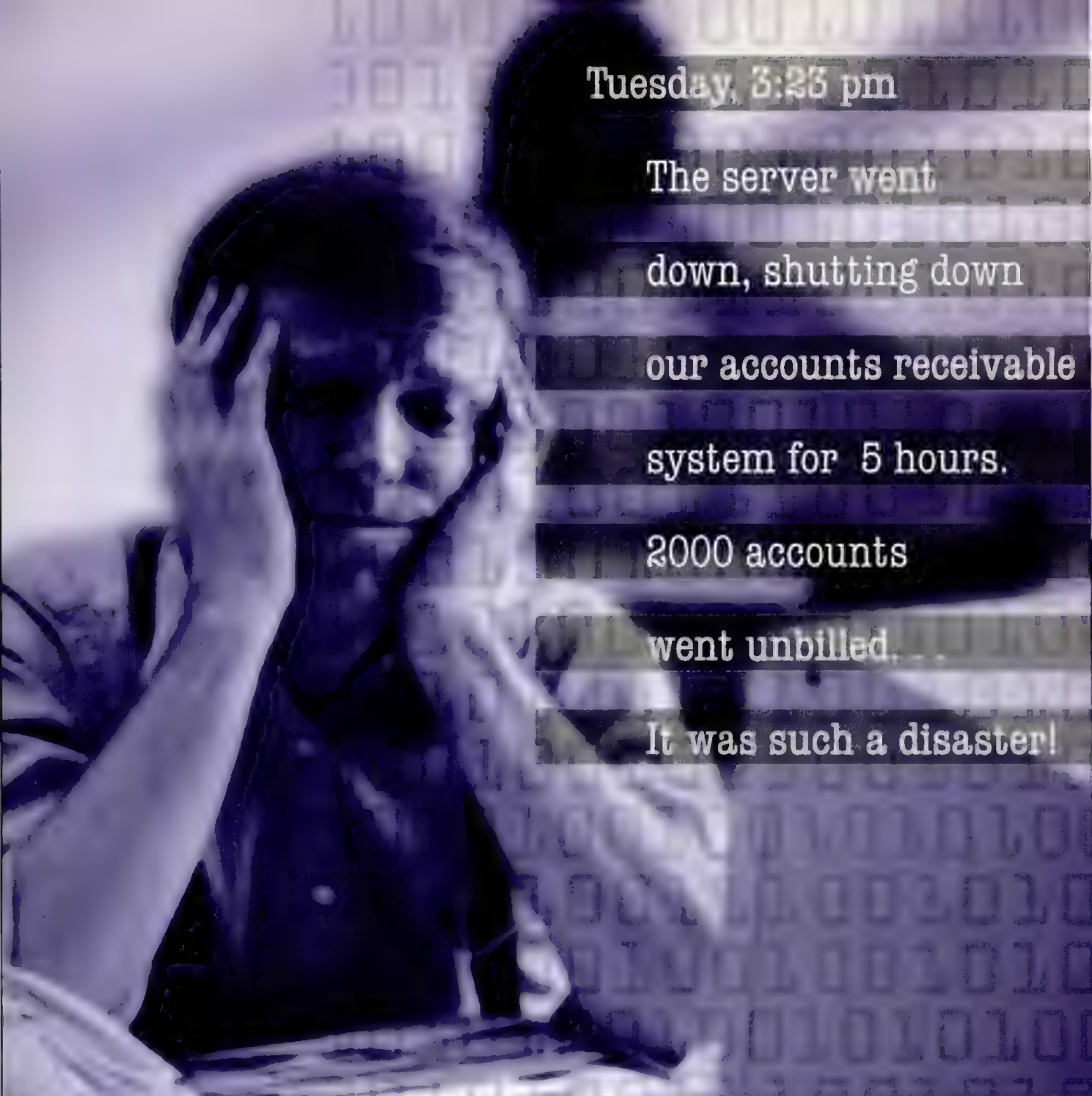
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*10-minute installation assumes running Windows 95 and using Eicon's ISDN line ordering service. The ISDN line must be installed and functional at installation.
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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

WEB SERVERS

The Little Web Server That Can!

By Jeffrey G. Witt

Small in stature and price but large in cost-effectiveness and usability, Cisco Systems' Micro Webserver (\$995) is aimed squarely at the ever-growing small- and branch-office sector. But the product isn't without enterprise potential. It can handle a modest ten connections per second and throughput of up to 2 Mbps. Though this doesn't

software runs off an embedded HTTP 1.1-compliant multitasking microkernel. Installing the Micro Webserver is a no-brainer. Assign it the Ethernet MAC address on the unit's underside and an IP address using the TCP/IP Bootp command. A walk-through wizard leads you through the rest of the process, which eliminates hand-wringing for those unfamiliar with the

with text, graphics, buttons, boxes, and tables from sample templates or from scratch.

The removable Zip drive accommodates easy content updates and off-line browsing applications for kiosk installations. The external SCSI feature increases content storage and allows for backup, and it lets you use the device as a document server. A connection switch on the rear of the server hooks up as many as six devices: five CD-ROM drives, and either a 1.2GB hard disk or another Zip drive. This lets you turn the Micro Webserver into a CD-ROM server. You can make HTML-based internal docu-

mentation, infobases, and hardware and software documentation easily accessible online, but you can read the information only with a browser.

The Micro Webserver also snaps easily into branch-office networks that are equipped with such devices as Cisco routers. The device's syslogs can be stored on the server, which lets you inspect network or router activity, statistics, and errors remotely. Router-configuration images and software updates are as easy as an FTP download. The Micro Webserver's HTTP kernel allows remote flash updates and management by the included SNMP agent.

Micro Webserver. List price: \$995. Cisco Systems Inc., San Jose CA; 800-553-6387; www.cisco.com. Circle 955 on reader service card.



A BIG SURPRISE in a small package: Micro Webserver has a home both in an enterprise- and small-office setting.

translate into the capacity to handle robust workloads, the Micro Webserver is capable of accommodating T1 bandwidth, making it ideal for ISPs that host personal Web pages. As for content creation, Cisco bundles Adobe PageMill 2.0 and Net-It Software Corp.'s Net-It-Now! with the product.

Roughly the size of an external CD-ROM drive, the Micro Webserver houses the popular Iomega Zip drive with 100MB of removable storage, an external SCSI connection, and a 10Base-T interface. The server

protocol or the commands.

With a series of mouse clicks, you can use the Java-based installation and configuration tools—which run in the latest Netscape and Microsoft browsers—to create users, groups, security attributes for passwords, and read/write rights, and to control content access. After we got the product running, we loaded several internal home pages in minutes. One drawback: The Micro Webserver can't accommodate CGI scripting, but the Form Builder lets you create HTML forms

NETWORK MANAGEMENT SOFTWARE

Managing the NT and NetWorlds

By Steve Rigney

The next networking challenge you could face is clear—centrally managing Windows NT Workstation clients attached to your NetWare or IntranetWare servers. But Novell now has a solution for this problem in Workstation Manager for Windows NT. This free, downloadable utility lets you attach Windows NT-based clients to your Novell Directory Services (NDS) tree, manage your NT users, set up different profiles on the same PC, and even send software updates to clients. It also lets you perform security tasks for both NetWare and Windows NT server access from a centralized location with an easy-to-use interface. The only drawback to this version of the

product is that it doesn't run on Windows NT Server.

Workstation Manager is just one of the components bundled with the Novell IntranetWare Client for Windows NT Workstation software. The software is approximately 13MB, so you may want to run the download overnight. The other components are the 32-bit IntranetWare Client software, NDIS drivers, and the Novell Application Launcher (NAL).

The 32-bit IntranetWare client will work with Windows NT Workstation and Server, and it allows you to connect and be authenticated to an NDS tree. You'll have to install the new IntranetWare Client if you want to use the other components, including Workstation Manager.

Though the Microsoft client

First Looks

for NetWare that comes with Windows NT 4.0 allows you to connect to a NDS tree, it doesn't provide total functionality. You can't attach to multiple trees, automatically upgrade clients, or use both ODI and NDIS card drivers as you can with the 32-bit IntranetWare Client. The IntranetWare Client also works with Novell's case 87 NetWare Core Protocols (NCP), which provide faster performance and use less bandwidth. Microsoft's client doesn't currently work with case 87 NCPs.

Workstation Manager is an extension to the NWadmin utility that lets you manage all your NDS objects, including servers, users, and groups. With Workstation Manager enabled, all your Windows NT-based client PCs

all user names to be authenticated via NDS before you can even access Windows NT. This provides centralized security and the ability to use a single log-on for both Windows NT and NetWare.

Workstation Manager replaces the Graphical Identification and Authentication module for Windows NT (GINA) with a program called NWGINA. NWGINA communicates with NDS and lets you dynamically create and delete Windows NT users accounts. NWGINA also attaches to the Windows NT machine with supervisor privileges and lets you configure all the Windows NT security information from a remote PC.

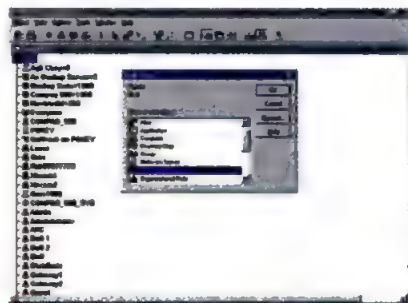
With NWGINA and Workstation Manager, you can store

user profiles on the network. User profiles include the applications that appear on users' desktops as well as the colors of their menus and screens. By storing this information on the network, a user can travel to another PC, log on, and still have the same applications and desktop.

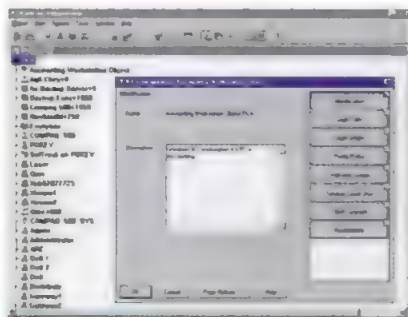
NWGINA also lets you configure the splash screen users see when they log on and control what log-on options they have. For example, you can configure a user to log on only to a specific server or tree and run a certain log-on script. By setting up multiple user profiles on a single NT

Workstation, different users can use the same PC yet retain separate applications and desktop designs.

The NAL component of the software lets you create network applications from a single PC and send them to all of your users. This is a great feature if



WORKSTATION MANAGER lets you create Windows NT configuration NDS objects.



YOU CAN CONTROL multiple settings for your Windows NT DNS objects.

show up as a Windows NT Workstation group and you can change different Windows NT-specific variables for those users. These variables include Windows NT user names and rights and specific profiles, such as the applications users can access.

Workstation Manager forces

CROSSTALK



Leon Erlanger

“Look at Cisco! It is offering everyone a completely turn key Web server for under a \$1,000. Of course it's in Cisco's best interest to build Web traffic, but the size, cost, and flexibility mark this as a very interesting product for organizations of all sizes.”

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Frank Derfler

you want to set up all the network applications for your users and even design their desktops. It prevents users from finding and creating icons for all of the network applications they might need.

NAL also provides fault tolerance and load balancing. The fault-tolerant feature lets you specify multiple servers for launching an application in case

the primary server isn't available. The load-balancing feature will automatically send you to another server for a program if the first one is bogged-down by excessive traffic.

Workstation Manager for Windows NT. List price: free for download. Novell Inc., Orem, UT; 801-222-6000; fax, 800-668-5329; www.novell.com. Circle 956 on reader service card.

TERMINAL EMULATORS

SNA Connectivity in a Snap

By Steve Rigney

Connecting your legacy system to your LAN has become easier. Eicon's Aviva Mainframe Edition and WRQ's Reflection Suite for Enterprise both offer 32-bit Windows-based solutions for connecting your LAN to your proprietary host computer. Though Aviva is limited to mainframe connections, Reflection can connect to almost any host, including AS/400 and Unix stations.

Each solution uses a different method to make the actual SNA connection, but each includes a scripting tool for creating hot links to legacy systems. Aviva is a great tool for pure SNA connections to a mainframe, but WRQ offers similar mainframe connectivity with many more bells and whistles.

Eicon Technology Corp.

Aviva Mainframe Edition

No longer do you have to run your TCP/IP and System Network Architecture (SNA) over separate wires. Eicon Technology Corp.'s Aviva Mainframe Edition, Version 7.20 (\$295 list), lets you connect mainframes and PC-based networks together on a single wire using the TCP/IP protocol. Corporations with a heavy investment in their SNA networks no longer have to worry about the expense of maintaining separate networks, and users can easily access legacy SNA applications. The product also provides easy installation and setup, a powerful macro language, drag-and-drop file transfers, and the ability to work

Microsoft Exchange Server

**outconfigures,
outadministers,
outscales,
outfeatures,
outmails**



and generally

outinternets

**all other messaging and
collaboration systems.**

(Outrageous? Not according to the experts.)

In comparative reviews by *Network World* and *Network Computing*, Microsoft® Exchange Server prevailed over Lotus cc:Mail, Lotus Notes/Domino, and Novell GroupWise as the Internet messaging champ. Microsoft Exchange Server garnered an overall score of 8.7 on a scale of 1 to 10 in *Network World's* review. And *Network Computing* dubbed

Microsoft Exchange Server its "Editor's Choice." Further proof that Microsoft Exchange Server is the best messaging and collaboration system available today—the recent Burke Marketing Research study. It concluded that 70% of IT Administrators prefer Microsoft Exchange Server over Lotus Domino and Netscape Mail Server.

Test it yourself: Try Microsoft Exchange Server 5.0 free for 120 days.

www.microsoft.com/exchange/promo/eval/

Microsoft

Where do you want to go today?®

Network World review published March 10, 1997. Network Computing review published March 15, 1997. Burke Marketing Research conducted December 1996.
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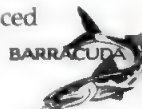
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CIRCLE 884 ON READER SERVICE CARD

NETWORK EDITION

First Looks

over standard SNA and Telnet connections.

Running as a 32-bit application on your Windows 95 and Windows NT desktops, Aviva is fairly easy to install as long as you know your host's IP addresses, node addresses, and

only problem we encountered was that the default time-out wasn't long enough. After we adjusted it, it still took us a minute and a half to log on.

One of our favorite high-end utilities in Aviva is the Eicon-Basic scripting language, which has the look and feel of Microsoft Visual Basic and lets you write OLE 2.0-based applications. The macro scripting is fairly easy to use, and Aviva includes a handful of sample scripts. You can also use Eicon-Basic to create hot spots and screen triggers that appear as text in your applications and launch macros when you click

on them.

Aviva Mainframe Edition, Version 7.20. List price: \$295. Eicon Technology Corp., Montreal, Quebec, Canada; 514-745-5500, fax, 514-745-5588, www.eicon.com. Circle 958 on reader service card.

WRQ Inc.

Reflection Suite for Enterprise

Best known as a terminal emulation package for connecting your Windows-based PCs to AS/400, IBM mainframes, and Unix hosts, WRQ's Reflection Suite for Enterprise, Version 6.5 (\$449 list), now offers other powerful features as well, including a Web browser, Web server, and a macro scripting language.

Reflection is extremely easy to install, requiring about 40MB of disk space for full installation. You can handle this quickly by putting a copy of the suite on a network server and installing it on multiple clients from there. The only problem we encountered was that the installation utility didn't create a Reflection 4 icon on our Windows NT desktop; we had to make one ourselves.

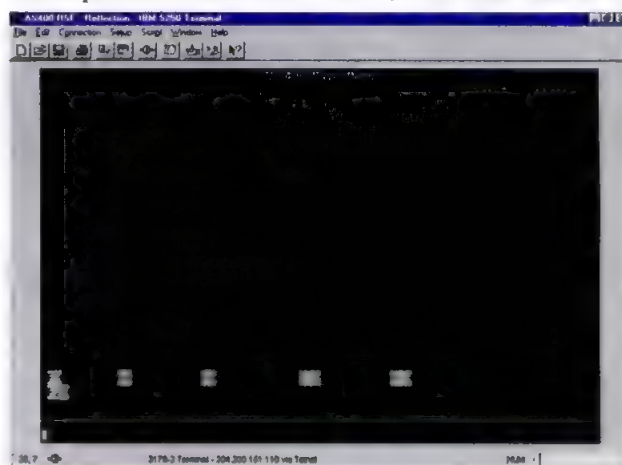
Unlike Eicon's Aviva, Reflection requires you to use a third-party product, such as

Novell's NetWare for SAA or Microsoft's SNA Server, to establish an SNA connection. But you can use the Multi Protocol Transport Network (MPTN) connection to convert between SNA and TCP/IP packets. Compared with the Data Link Switching Aviva uses to encapsulate SNA in a TCP/IP packet, MPTN's conversion technique requires less overhead and is faster. It also lets you perform tasks that can't be done over a Telnet session, such as printing to a 5250 printer. Both the Telnet and MPTN connections are extremely easy to set up and use. The only information needed is the IP address or host name and the terminal type. We connected to WRQ's AS/400 within a matter of seconds. You can establish a Telnet connection using a direct TCP/IP network connection or a dial-up PPP or SLIP connec-

a terminal session and save them as a macro to run later. Like Aviva, you can create hot spots on the display screen that will launch a macro when you click them.

A thoughtful addition to the Reflection Suite is the Web browser and server. The server is designed for small workgroups and is not powerful enough to handle multiple connections. The server manager lets you automatically start and stop the Web server plus other utilities including ftp and finger service. A Web browser is included, but it doesn't support frames or Netscape plug-ins.

Also useful is the dial-up terminal application. Like the Hyperterminal Utility in Windows 95 and Windows NT, the dial-up terminal utility lets you connect to multiple online services, such as MCI mail, CompuServe, and other BBSs. It



More than mainframes: Reflection Suite can connect to the AS/400s and Unix hosts as well as to mainframes.

tion to the Internet/intranet.

Like Aviva, Reflection has a powerful macro language you can use to perform automatic tasks, such as logging on or transferring data to and from the host. The macro language is compatible with automatic OLE 2.0, so you can embed information in other applications, such as Microsoft Excel and Access, which will establish a host connection and send information automatically. You can record your keystrokes during

doesn't work, however, with the TAPI unidriver modem files in Windows NT and Windows 95, and you must select your modem from a list. To make matters worse, Reflection didn't include an initialization string for our US Robotics Courier V. Everything modem. **Reflection Suite for Enterprise, Version 6.5.** List price: \$449. WRQ Inc., North Seattle, WA; 206-217-7100; fax, 206-217-0293; www.wrq.com. Circle 957 on reader service card.



Gotcha: Aviva's Desktop DLSw makes getting an SNA connection easier.

Logical and Physical Units. The product takes a few minutes to install on each PC, but it works with Microsoft Systems Management Server so you can install and configure the software remotely.

Aviva establishes a true SNA connection to a mainframe using the TCP/IP protocol by encapsulating or tunneling SNA information in TCP/IP network packets. Aviva does this through the open Data Link Switching (DLSw) standard. You need DLSw-compliant routers, however, at each end of the connection.

To address incompatibility issues with DLSw-compliant routers, Eicon developed its own specification called Desktop DLSw. Like DLSw, Desktop DLSw allows you to tunnel, but it doesn't require SNA on the desktop and you need only a single DLSw-compliant router at the host side of the connection. You can use any TCP/IP router at the remote location. Desktop DLSw works over your existing TCP/IP network and dial-up Point to Point Protocol connections, so you can attach to an IBM mainframe using a regular dial-up Internet connection. On our tests, we accessed an IBM mainframe at McGill University using a PPP connection. The

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† Dell'Oro Report, and Quarter 1996 IDC 12154 Remote Access Bulletin.

† Products are 56 Kbps-capable. However, due to FCC rules which restrict power output, download speeds are limited to 53 Kbps.



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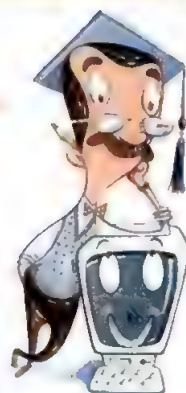
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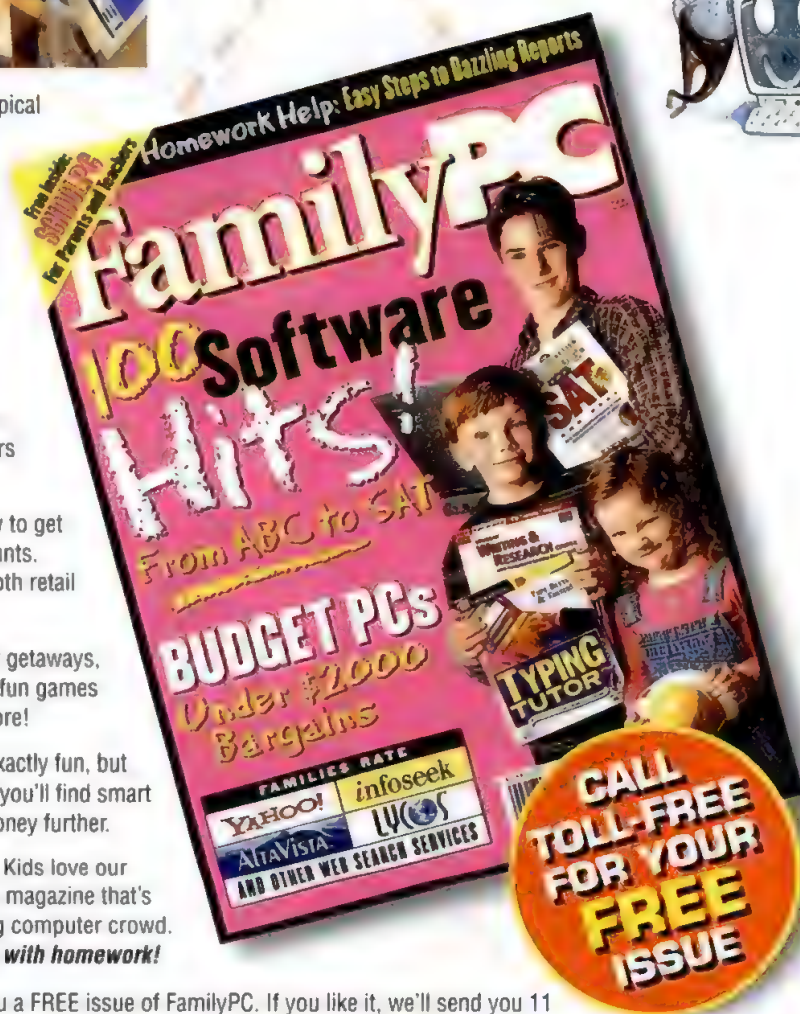
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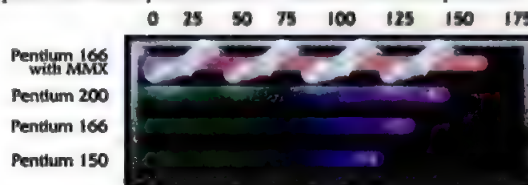
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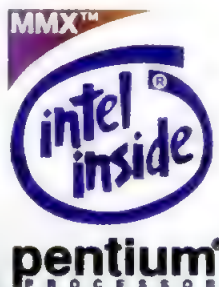
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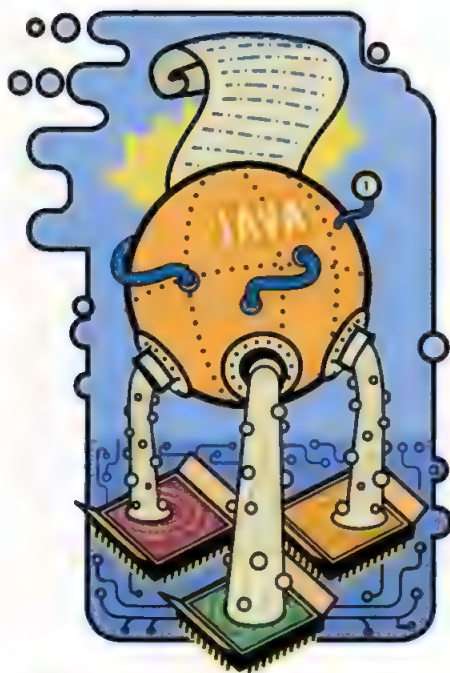
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JAVA

A Field Guide for Users

Behind all the hype, Java is making a serious bid for business desktops. Here's what you need to know.

By Richard V. Dragan and Larry Seltzer

Even by Internet standards, the remarkably fast rise of Java is mind-boggling. Indeed, talk of Java has become so pervasive that you'd be hard-pressed to pick up a computer magazine without reading at least one contrived coffee metaphor. In its two years of formal existence, Sun Microsystems' programming language has evolved from a tool for dressing up Web pages to the next great platform for Internet/intranet computing. And because Java is designed to be platform-independent, it also represents, for many vendors, a chance to chip away at the Wintel fortress.

All this without any true productivity applications out the door yet.

But whether or not you believe all the hype, the fact is that Java has already shown it has the potential to influence the desktop computing landscape. Like Netscape, Sun has led the charge for open standards—using Java to spearhead its campaign. (At press time, Sun announced plans to make its Java specifications a public standard subject to independent review.) Together with com-

panies like IBM Corp. and Oracle, Sun has also focused the spotlight on cost of ownership by promoting network computers (NCs) for running Java.

To separate fact from fiction, we took a hard look at the state of Java from a user's perspective. Our coverage is divided into two sections. First we review early versions of some actual Java-based business productivity suites and sample some innovative Java applets on the Web. Then we test the various environments (Java-enabled Web browsers) and platforms you

can use to run Java programs. Our testing involved seven different platforms, from desktop PCs to Sun's JavaStation.

The results we saw were surprisingly mixed. Java performance varied widely, depending on which operating systems and browsers we used. More frustrating, Java programs that ran fine on one configuration were unreliable on the next. Sun's mantra of "write once, run anywhere" is alluring, but our testing indicates that it may be some time before



WHAT IS JAVA?

Java is a programming language like C++, not a page description language such as Hypertext Markup Language (HTML). Originally developed by Sun Microsystems for hand-held electronic devices, Java was engineered to be small and platform-independent, making it well suited to the Web. Some good Java resources on the Web include Sun's JavaSoft site at java.sun.com and Gamelan, a Java registry located at www.gamelan.com



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Java is ready to take its place across corporate desktops.

Performance issues aside, Java faces other hurdles in its sprint toward mainstream business applications. Because Java programs must be small to work well on networks, they include just a fraction of the features you'd expect from a typical office suite. Most vendors are operating here on the 80/20 theory: 80 percent of users employ only 20 percent of an application's features on a regular basis. Though there may be some truth to that, the fact is, if you've got some experience working in, say, Microsoft Office, using these Java applications will feel like a step backward.

At the moment, the most glaring omissions are the lack of support for secure local file storage and printing. The reason is that all of these programs are based on Version 1.0 of Sun's Java Development Kit (JDK). The recently released JDK 1.1 will address these problems.

Compared with Windows programs, most of the Java applications we tested also had relatively simplistic interfaces and limited feature sets. The text editor in Cooper & Peters' EyeOpener, for exam-

ple, looked a lot like WordPad to us. And the pre-beta version of Corel Office for Java lacked all but the most basic formatting options. The exception was Applix's Anyware Office, which offered a surprisingly complete feature set. (It's also the only shipping product in the group.) It was the only product we looked at that handles legacy files, though all vendors are promising this capability.

Long before Sun settled on the trendy name, Java began life as Oak, a streamlined programming language for handheld devices and set-top boxes. Oak met with little commercial success, and in 1995 Sun recast the technology as a programming language for the Internet called Java and introduced the HotJava Browser. But it wasn't until Netscape incorporated Java support in Navigator 2.0 later that year that it began to garner a lot of attention.

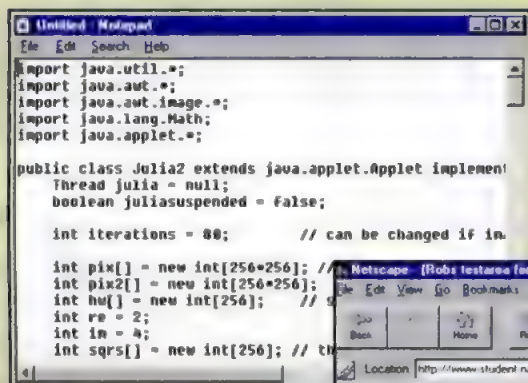
Java is two things. First, it is a programming language—one heavily indebted to C++. But its real charm is that it is also a runtime environment that can be executed on any system. Traditional programming languages like C++ use tools called *compilers* to generate sets of native instructions

optimized for a specific processor, such as x86, PowerPC, or SPARC. By contrast, Java classes are compiled into a set of instructions called Java byte code. The lingua franca of the programming world, Java byte codes can be executed on any system that has a Java virtual machine (VM)—a virtual model of a CPU. This cross-platform concept is appealing to developers who write enterprise applications for organizations that use a variety of platforms.

Currently, the most widespread use of Java is on the Web or on corporate intranets, where developers have employed it for creating *applets*—interactive page elements or basic applications that you view within a browser. HotJava, Microsoft Internet Explorer, Netscape Communicator, and Netscape Navigator are all Java-enabled browsers, as is the integrated browser in Lotus Notes 4.5. It's also possible to write Java applications, which run either inside a Web browser or as standalone applications on operating systems with Java VMs.

THICK AND THIN

While Windows programs seem to swell in size with each new release, the Java



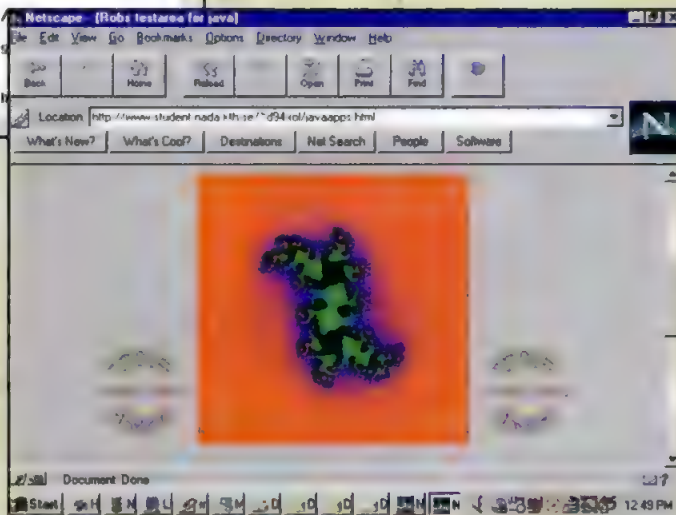
HOW DO YOU RUN JAVA APPS?

Java programs can be run on any system that has a Java virtual machine (VM). The good news is that you probably already have one. Web browsers such as Microsoft Internet Explorer, Netscape Navigator, and Sun's own HotJava have Java VMs built-in. Like an actual CPU, the Java VM interprets the Java byte codes at runtime for the specific hardware and software platform. Some Java VMs also include just-in-time compilers (JITs), which significantly increase performance.

WHAT'S ALL THE FUSS ABOUT?

Most programming languages such as C++ compile source code into machine code, or native code, optimized for a specific platform such as Intel x86 or PowerPC. In contrast, a Java compiler translates source code into Java byte code (.class), a set of instructions that is not optimized for any particular platform. Think of it

as an added layer that sits between the byte code and the system's CPU. The advantage of this is that Java executables can be run on any system that has a Java byte-code interpreter. The disadvantage is that Java programs run considerably slower than those optimized for particular platforms.



WHAT CAN YOU DO WITH IT?

Java can be used to create simple applets such as scrolling banners and animation for spicing up Web pages. It can also be used for building full-fledged applications. To write Java code (.java), you'll need a development environment such as Sun's Java Development Kit (JDK) or a graphical Integrated Development Environment such as Symantec's Cafe or Microsoft Visual J++.

This Java applet, Robert Olofsson's Julia animator version 2.0, generates a Julia fractal design. The source code, provided at www.student.nada.kth.se/~d94-rol/javaapps.html is shown above left.

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applications here are relatively small—though this is due more likely to their limited feature sets than to any characteristics of the programming language. The small program size offers two potential advantages. First, it means that Java applications are a good fit for the Internet, where bandwidth is limited. Second, because the applications are small and can be downloaded on demand from a centralized server, Java computing may not require the same level of hardware. Sun wants companies to buy Java devices (and, of course, run their applications from a Sun server) rather than replacing those old 3270 terminals and 386s with relatively expensive Pentium desktops. Because they lack local storage, NCs are supposed to be less expensive than PCs. Sun claims that the NC model will also reduce the cost of ownership by simplifying administration.

With agnostic tendencies and a network-centric model, Java poses a clear threat to Microsoft and Intel. It's therefore no surprise that neither company is taking it lying down. On the software front, Microsoft is pushing ActiveX (a programming model based on COM, itself the basis of OLE) as a native code alternative for building interactive Web programs, while simultaneously embracing Java. On the hardware end, Microsoft and Intel have jointly released the specifications for the NetPC, a "sealed case" business desktop that will start at \$1,000.

The battle lines in the war for corporate desktops seem to have been clearly drawn. But when you cut through the marketing hype, the fact is that Java could coexist nicely with Windows PCs or just about any system—assuming it lives up to its billing as a platform-independent architecture. Also, Java developers must show that the platform can deliver true business productivity applications that are reliable across a variety of platforms and perform on a par with Windows-based applications. No small task, but despite its current limitations, Java still offers the best hope of achieving it.

Our Contributors: EDWARD MENDELSON and CRAIG STINSON are contributing editors of *PC Magazine*. LARRY SELTZER and BEN Z. GOTTESMAN are technical directors and RICHARD V. DRAGAN is a programmer at PC Magazine Labs. JOHN MORRIS was the associate editor in charge of this story, and DIANE JECKER was the project leader.



By Edward Mendelson

Running a complex Java program today is like piloting an experimental airplane. The flight is bumpy and landings are rough, but the ride is exciting. As we discovered, current Java applications tend to be technology demonstrations rather than usable programs. But they provide a glimpse of what Java computing will look like.

Programs written in Java don't do anything that can't be done by ordinary Windows programs written in C++ or any other language. In fact, the Java programs reviewed here include just a fraction of the functionality found in most Windows productivity applications. But the advantage to using Java programs is that you can download them from the Internet or a server when you need them, and then run them on any platform with a Java virtual machine.

Most anyone who's spent time on the Web has seen Java applets, the tiny programs that make pages interactive (see the sidebar "The Applets of Our Eyes"). But it is only recently that vendors have turned to Java for developing full-scale, business productivity applications. Even Microsoft is rumored to be working on a Java suite. For this roundup, we reviewed three such Java suites: Applix's Anyware Office, Corel Corp.'s Corel Office for Java, and Cooper & Peters' EyeOpener. We also previewed Lotus Development Corp.'s Java-based suite, code-named Lotus Kona.

Like anything viewed in a browser, the Java programs that you find on the Net or use on a network will vary in looks, speed, and reliability. Browsers are notoriously buggy, and our testing confirmed that running Java programs can be a hit-or-miss proposition. Some programs crash in Netscape Navigator, for example, but run fine in Internet Explorer, or vice versa. We even found problems among different versions of the same browser.

Is Java a cool technology? Without a doubt. But don't throw out those overgrown office suites just yet.

Applix Inc.

Anyware Office

Perhaps more than any other Java developer to date, Applix has set out to demonstrate that Java-based office applications for the thin-client world can be almost as powerful as Windows-based programs on desktop PCs. Applix's Anyware Office suite includes many of the features of Microsoft Office—along with some extras that you won't find in any desktop suite.

But while Anyware Office is thin, its price tag is not: \$295 (list) per concurrent user plus \$4,995 for a server component (which supports an unlimited number of users). You can sample most of the suite's features in a demo version at Applix's Web site. An e-mail client is included in the suite but was not enabled in the online version. Applix offers a data-query tool for an extra \$195 per seat.

We tested the word processing and spreadsheet components. The Applix word processor generates ordinary text documents and HTML, and it includes support for stylesheets, tables, embedded clip art and audio, date and numbering fields, indexes, and cross-references. The

The Applets of Our Eyes

Java applets may be small in terms of file size, but they can do some pretty big things. The best of today's Java applets deliver information and entertainment hard to find anywhere else.

Unlike standard images on Web pages, images in Java applets can be moved or modified in response to user input. In the garden-planning applet at Garden Escape (www.garden.com), for example, you select from catalogs of plants in a tabbed list, then place images of each plant on a diagram of your garden. It looks beautiful, but you can't print it, because no browser



J-Track displays the paths of artificial satellites superimposed on the current cloud cover.

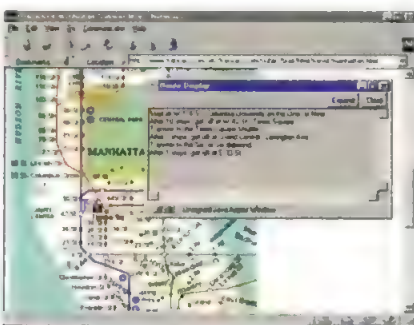
lets you print Java-based images yet. The main advantage to the applet is that a Java-based shopping basket lets you order and pay for the plants you selected online.

Of course, Java's interactive features can be used for more academic enterprises, such as generating curves from mathematical formulas. In the Spirograph applet (www.wordsmith.org/~anu/java/spirograph.html), for example, you set the sizes of stationary and rotating circles by moving sliders that alter variables in a mathematical formula. The applet generates the resulting curve on-screen. The Manipula Math site (www.campusnet.or.jp/~tsuyuki/java/iesjava.html) offers

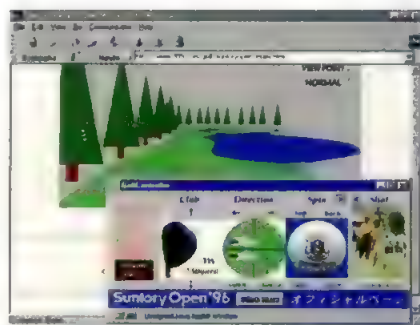
more than 20 animated applets that demonstrate calculus and other types of math. The world's most modern abacus is The Abacus (a Java applet at www.ee.ryerson.ca:8080/~elf/abacus).

Real-time displays of complex data on Web pages are another Java specialty. The fascinating J-Track site (liftoff.msfc.nasa.gov/home/mission/jtrack/welcome.html) shows a world map with the current position of major artificial satellites, superimposed over an illustration of the current cloud cover. You can find a variety of applets that display current national and local weather. And if you want an applet that tells you more than you would learn from looking out the window, visit the Forecast Systems Laboratory (www-md.fsl.noaa.gov/efi/internal/GFVUsersMan.html) for a detailed animated forecast of Colorado's weather (but no other state's) over the next 48 hours.

We haven't found a Java applet that links to the Global Navigation System satellites, but if you're lost in the New York City subways, you can point your laptop's browser to The Interactive New York Subway Map (www.transarc.com/afs/transarc.com/public/braill/html/transit/manhattan.html) and find the fastest route to your destination. For demographic information, try the Active Maps site (internetgis.com), which includes maps that display state-by-state data on crime and weather. You can also build queries to extract data from them.



New York's subways can be daunting, but Subway Navigator pinpoints the best route.



Improve your swing online with Sun Microsystems' 3-D Open virtual golf game.

Java can control sound as effectively as it controls images. If you ever wanted to play the steel drums, check out the Trinidad-based Pan Java site (sealus.umn.edu/untpdc/incubator/tto/tppos/panjava), where you can record melodies by clicking on different regions of a drum and play back your creations later.

Die-hard sports fans who can't tear themselves away from their computers will find plenty of Java action on the Web. For play-by-play coverage of major-league baseball, jump to Instant Ballpark (www.InstantSports.com/ballpark.html), which displays actual Java simulations of current games. Golfers can perfect their games on a virtual version of the famous Turnberry course in Sun Microsystems' 3-D Open virtual golf course (www.999.com/sunopen). Board games adapted to Java include Scrabble (www.gragsie.com/Scrabble), the Java version of which you can play against yourself. Many of the most well-known computer games have also been written in Java.

To find these and hundreds of other innovative Java applets, start your search at EarthWeb's Gamelan Java registry (www.gamelan.com), the Java Applet Review Service (www.jars.com), or Mojoe MultiMedia (www.mojoe.com)—three sites that rate Java applets and applications and have links to virtually any applet or Java resource on the Web.—EM

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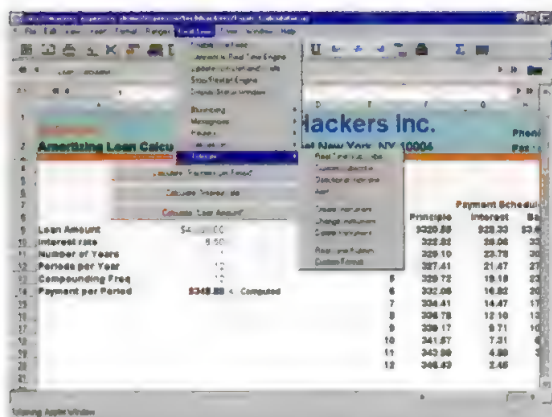
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Applix's Anywhere Office includes a set of tools for pulling real-time data into documents.

word processor also comes with a dictionary, thesaurus, and spell-checker.

An unusual feature of the spreadsheet is a set of real-time data-acquisition tools and functions. These let you subscribe to, for example, a market-quote service and set up function calls that update your spreadsheet at intervals of your choosing. Other notable aspects of the Applix spreadsheet include a goal seeker, support for named ranges and views, on-sheet sorting and querying commands, and a full set of charting options. Wizards, gallery-style menus, a sum button, and templates for loan calculation, expense rates, and so on will make émigrés from the desktop world feel reasonably at home.

Both the word processor and the spreadsheet include macro capability, albeit in a language you may not already know. The Applix suite is the only one that currently allows access to legacy files via more than 50 import and export formats.—*Craig Stinson*

Anywhere Office. List price: \$295 per concurrent user; server component, \$4,995. Requires: Server (Alpha, PA-RISC, Pentium-based PC, or SPARC) and any client with a Java virtual machine. Applix Inc., Westboro, MA; 800-827-7549, 508-870-0300; fax, 508-366-2278; www.applix.com. Circle 467 on reader service card.

Corel Corp.

Corel Office for Java

Corel seized the Java spotlight early by announcing plans to port its WordPerfect Suite to the nascent language—a formidable task that is still not complete.

We tested a pre-beta version downloadable from Corel's Web site (the final product should be available in June). Corel Office for Java runs as an applet (inside your browser or an applet viewer) or as a stand-alone Java application. The components are tightly integrated, allowing you to insert a Quattro Pro spreadsheet component, for example, into a WordPerfect document. Future versions will add presentation and drawing modules and an e-mail client to the mix, and a server-side package will add data-

base access, printing, and spell-checking.

The Java suite looks like a stripped-down version of Corel's Windows suite. You won't find a top-line menu or any other Windows-style menu. Functions are accessed through the toolbar buttons and drop-down menus. A ruler optionally appears in WordPerfect, and a formula bar appears in Quattro Pro with buttons for autosum, sorting, and a function wizard.

The pre-beta Java version of WordPerfect supports only basic formatting features, but Corel plans to support headers and footers, text columns, spelling, and styles in the shipping version. Quattro Pro, in its pre-beta version, offers a simple formula wizard with 140 functions and a bare-bones charting feature.

Corel Office for Java won't satisfy power users. It's a thin program suited to thin-client computers, but it may be an enticing alternative for those who use suites to accomplish simple tasks.—*EM*

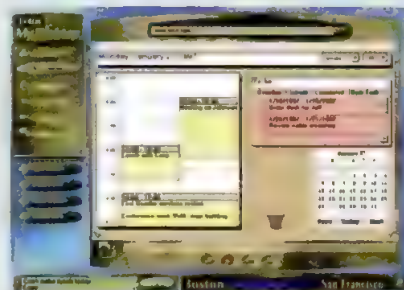
Corel Office for Java. List price: Not yet announced. Requires: Any system with a Java virtual machine. Corel Corp., Ottawa, Ontario, Canada; 800-772-6735, 613-728-8200; fax, 613-761-9176; www.corel.com. Circle 468 on reader service card.

Cooper & Peters

EyeOpener

Cooper & Peters is a small software firm that has been making object-oriented tools and programmer gadgets since 1988. The company's Java application suite, code-named EyeOpener, is its first foray into end-user software, and it still looked like a set of tools and gadgets

Kona Coming Soon



Lotus's NC Desktop for network computers.

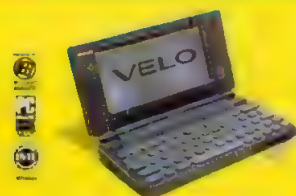
Squeezing an overblown office suite into a set of downloadable Java applets is like fitting an elephant inside a shoebox. Rather than create a Java version of its SmartSuite office suite, Lotus Development Corp. went back to the drawing board to build a new set of applications, code-named Lotus Kona.

The productivity applications function as a set of components for accomplishing specific tasks rather than as a single suite. Lotus is also going a step further by developing a GUI aimed specifically at network computers (NCs). The NC Desktop we saw included a Web browser, PIM, e-mail client, file manager, terminal emulator for accessing legacy data, scrolling banner, and paging function.

The separate productivity applications include a text editor, spreadsheet and charting programs, a calendar and PIM, an e-mail client, a project scheduler, a presentation package, and a data-access applet. Trial versions of some modules should be available at kona.lotus.com by the time you read this.

The pre-alpha version of the text editor we previewed included some nice formatting options, such as text wraparound and multiple columns. The Kona applications are also designed to be modular, so you can download added features like mail-merge. Currently, the applications do not access legacy files, although Lotus promises to provide that capability in the shipping versions.—*John Morris*

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when we tested a pre-beta online demo.

The applications are rudimentary; many of the program's functions were disabled in the demo, and the interface lacked menus. The suite does have a strategy, however: to combine Microsoft Office 95 file compatibility and an Office-like user interface with Java's platform-independence. EyeOpener consists of a word processor, spreadsheet, chart builder, and graphics editor, along with a Java code editor.

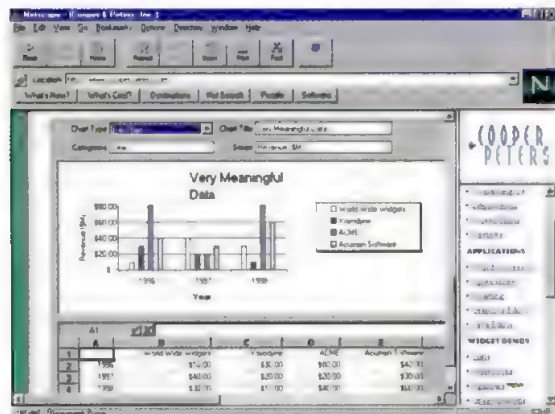
The word processor is a WordPad look-alike suitable for basic notetaking, and for viewing and printing text files. A toolbar at the top provides basic file commands and a second toolbar provides formatting functions identical to those in WordPad.

EyeOpener's spreadsheet includes toolbar controls that let you sort rows, add up cells, select items from the program's function library, and assign numeric, text, and date formats. However, analytic horsepower is limited, and common amenities, such as the ability to point to cells while building formulas, are absent.

The chart builder offers simple column charts, 3-D stacked column charts, line charts, and two- and three-dimensional pies. The graphics editor lets you build simple org charts and diagrams.

EyeOpener may be an interesting demo of what can be done in Java, but it was well short of providing satisfactory application functionality.—CS

EyeOpener. List price: Not yet announced. Requires: Any system with a Java virtual machine. Cooper & Peters, Boulder, CO; 303-546-6828; fax, 303-546-6826; www.cooper-peters.com. Circle 469 on reader service card.



Cooper & Peters' chart program, EyeOpener, lets you plot data in five chart styles.

JAVA ENVIRONMENTS

By Larry Seltzer

The Java virtual machine (VM) is critical to the platform independence and performance of Java-based applications. We tested 21 Java VMs available in Web browsers for 7 different platforms, including a Sun JavaStation.

Given that all Java VM vendors start with JavaSoft's code, you might assume their products are all pretty much the same. Not so. Our tests found myriad differences between the Java VMs. For the first time since we started using our JMark tests, we ran into VMs that were incapable of running perfectly legitimate Java code.

The Win32 browsers tend to be not only faster but more stable and more compatible with Java code. All of the Win32 VMs, with the exception of Sun's HotJava 1.0, have just-in-time compilers (JITs), which significantly boost performance. That's not the whole story, since other browsers in this group, such as Navigator 2.02 for OS/2 Warp, also have JITs. In the case of Macintosh and Windows 3.x, part of the difference can be attributed to the lack of native thread support. The reasons behind the subpar performance under OS/2 and Linux are less obvious, although they may be related to the amount of attention the VM receives from the vendor.

MICROSOFT WINDOWS 95/WINDOWS NT

As a class, the Win32 browsers—running under Microsoft Windows NT or Windows 95—are the cream of this crop for running Java applications. We tested HotJava 1.0 with the Java Runtime Environment, from Sun Microsystems; the Lotus Notes 4.5 client; Microsoft Internet Explorer 3.01; Microsoft Internet Explorer 4 (beta 1); Netscape Communicator, preview release 2; and Netscape Navigator 3.01. Both Netscape Communicator and IE 4 are scheduled to receive new, much faster JITs soon, and they may be available by the time you read this.

Among the VMs we tested, the Internet Explorer VMs under Windows 95 and Windows NT 4.0 were the fastest overall. HotJava and the non-Win32 browsers were at the other end of the performance spectrum. Communicator is much faster than Navigator at graphics operations, and is usually faster in these than the Microsoft VMs. These functions

are independent of the JIT, since the Abstract Window Toolkit (AWT) functions run as native code, and they're an indicator of good overall performance in Communicator, which will include the Symantec JIT before it ships. (Borland's JIT is currently in the product.)

HotJava's numbers on the nongraphics tests suffered greatly from the lack of a JIT. Under both Windows 95 and Windows NT, HotJava was the slowest VM we tested on all eight nongraphics tests. It did much better on the graphics tests, indicating that JavaSoft has made real improvements in its AWT code, which is less affected by byte-code interpreter performance.

The Lotus Notes 4.5 client can operate as a standalone Web browser with Java support. Its performance was at the low end for Win32 but was generally respectable.—LS

WINDOWS 3.X

It was almost sad to watch 16-bit Windows for Workgroups try to run Java. Browsers and Java VMs were designed originally for 32-bit systems, and retrofitting them for Windows 3.x puts the fish in very shallow water. We looked at two Java-capable Win-

PERFORMANCE TESTS

Java VMs



It's clear that browsers with just-in-time compilers—especially those running on Win32 platforms—deliver the best results.

What the Numbers Mean

There's no technical reason for Win32 VMs to outperform others, but we suspect that vendors are devoting more attention to their Java implementations for Windows 95 and Windows NT. The Win32 version of HotJava's virtual machine (based on the Java Development Kit 1.1) was an exception to this rule, but it lacks a JIT, so we expected its performance to lag. The other Win32 Java VMs (all based on JDK 1.0x) were the only ones that could handle all of our JMark tests without crashing or requiring some sort of accommodation from our developers. It's also fair to conclude that

Bold type denotes first place for each platform.

	AWT Graphics Mix Score	AWT Blits/Images Score	Vectors Score	Hash Table Score	Stacks Score
MICROSOFT WINDOWS 95					
HotJava Browser 1.0	1,917	1,249	670	1,517	535
Lotus Notes 4.5	2,054	660	1,237	3,077	1,059
Internet Explorer 3.01	2,166	689	1,784	4,356	1,611
Internet Explorer 4 (beta 1.0)	2,154	744	1,818	3,588	1,636
Communicator (PR2)	2,078	1,463	1,382	1,972	1,397
Navigator 3.01	1,722	578	1,479	2,696	1,301
MICROSOFT WINDOWS NT 4.0					
HotJava Browser 1.0	2,596	1,228	684	1,554	547
Lotus Notes 4.5	2,917	514	1,216	3,186	965
Internet Explorer 3.01	3,639	565	1,941	4,631	1,750
Internet Explorer 4 (beta 1.0)	3,065	577	1,880	3,508	1,467
Communicator (PR2)	2,847	1,417	1,512	2,361	1,362
Navigator 3.01	2,296	377	1,516	2,936	1,373
MICROSOFT WINDOWS 3.x					
Communicator (PR2)	588	97	133	389	117
Internet Explorer 3.01	2,231	N/A	48	134	43
OS/2					
Navigator 2.02	853	271	868	2,373	757
MACINTOSH					
Internet Explorer 3.0a	1,434	363	651	1,774	538
Communicator (PR2)	691	298	412	749	368
Navigator 3.01	1,117	740	549	1,274	472
LINUX					
Communicator (PR2)	2,675	1,422	293	667	256
Navigator 3.01	N/A	N/A	N/A	N/A	N/A
JavaOS (SUN JAVASTATION)					
HotJava Browser (LAR)	1,690	862	371	888	307
	BETTER ►	BETTER ►	BETTER ►	BETTER ►	BETTER ►

N/A—Not applicable. The browser could not complete this test. PR2—preview release 2. LAR—limited-access release

dows 3.x browsers for this story: Microsoft Internet Explorer 3.01 and Netscape Communicator, preview release 2.

As we were finishing our testing, Microsoft released the final version of Internet Explorer 3.01 for Windows 3.x with the 16-bit Java VM included. While the final version of IE 3.01 was significantly more stable than the beta VM, it produced markedly low test scores. In fact, Internet Explorer's

VM had the lowest score of any Java VM we tested on every nongraphics test. On the Towers of Hanoi test, for example, the highest score we saw (IE 3.01 under Windows 95) was more than 170 times the score produced by the Windows 3.1 VM. Furthermore, it failed to run the AWT Blits and Images and Graphics Threads tests.

Communicator for Windows 3.x was better but still well below average. Not co-

incidentally, it was the second-slowest VM we tested on every nongraphics test, just ahead of IE 3.01. It locked up on the Graphics Threads test in the same way that it did under the Mac OS—which, incidentally, also has no OS support for threads. This is a test that typically takes 8 to 25 seconds to complete; Communicator took almost 30 minutes to get to the end of the test and lock up.

Java in Internet Explorer is faster than it is in Netscape Communicator and Navigator, a pattern we've seen during past testing. Both Microsoft and Netscape are on the verge of releasing much faster Java VMs.

Under Linux, Netscape Navigator 3.01 was unable to run our tests without crashing. Similarly, both Netscape Communicator and Navigator on the Macintosh—and Communicator under Windows 3.x—crashed at the end of the Graphics Threads test. This is not entirely surprising, because none of these platforms support native threads.

Although we tested 21 Java VMs on 7 different operating sys-

tems, we were able to use one hardware configuration for all platforms but Mac OS and JavaOS. The Mac we used for testing was a Power Macintosh 4400/200 with 16MB of RAM. We also used a Sun JavaStation with 64MB of RAM connected to a Netra J server. We ran all the x86 configurations on a Pentium/133 Micron system with 16MB of EDO RAM and an ATI Mach 64-based graphics adapter. We set the graphics configuration at 800-by-600 resolution with 24-bit color for all platforms except Linux (16-bit) and JavaOS (8-bit). Our JMark test suite is available at www.pcmag.com/pclabs/bench/benchjm.htm.—Analysis written by Larry Seltzer

Bubble Sort Score	Quick Sort Score	Towers of Hanoi Score	Fast Fourier Transform Score	Memory Allocation Score	Graphics Threads Seconds
342	3,684	159	105	66	17
1,234	6,258	379	368	323	19
3,060	16,511	1,193	717	266	15
3,073	16,309	1,179	729	218	15
1,675	8,706	801	521	130	13
1,645	7,620	821	514	113	21
385	3,786	159	106	61	8
1,230	5,904	473	375	289	14
3,145	18,044	1,241	733	256	7
3,151	20,011	1,231	746	215	7
1,692	9,336	832	533	150	7
1,665	8,110	889	524	117	16
45	634	23	13	53	N/A
22	232	7	7	20	N/A
1,455	5,283	581	436	200	40
728	2,171	391	312	116	20
200	2,637	104	66	103	N/A
205	2,711	108	68	176	N/A
120	1,465	61	34	106	20
N/A	N/A	N/A	N/A	N/A	N/A
186	1,690	80	61	121	36
BETTER ▶	BETTER ▶	BETTER ▶	BETTER ▶	BETTER ▶	◀ BETTER

Windows 3.x browsers and Java VMs are at a disadvantage because they deal with large amounts of code and data in 64K segments. If you're serious about Java, Windows 3.x is not your platform.—LS

OS/2 WARP 4

IBM Corp.'s OS/2 Warp 4 is the first operating system out of the chute with a powerful approach for Java computing.

IBM's Java VM is integrated in many ways with the operating system to offer greater depth and efficiency. Though this version of IBM's Java VM delivered meager performance when compared with the others we tested, it marks a commitment to Java by IBM that will please OS/2's many users.

The single Java VM approach in OS/2 means that all browsers can use the im-

plementation of Java as their own, so that a single optimized Java VM can be shared between Java browsers or standalone applications. We tested Netscape Navigator for OS/2 Version 2.02e with IBM's add-on for the Java VM with JDK 1.0.2 support. This Java VM includes a JIT for better performance, though it lagged in comparison to those JITs under Win32. Enhancements to this version included optimized

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AWT code, as well as improved Java security. The OS/2 Java VM allows users to access the utilities inside the JDK within the system toolbar, including the Java applet viewer and the Java compiler.

On our JMark tests, there was a problem with thread performance on our Graphics Threads test. This version of the IBM Java VM had middle-of-the-road performance, though it was actually at the top of the heap in performance in non-Win32 Java VMs.

Future plans for OS/2 Java include an early version of the JDK 1.1 for OS/2, expected soon. Besides OS/2 Warp 4, IBM is porting the JDK to a variety of platforms, including AIX, OS/400, and Windows 3.1.

The support for Java in OS/2 Warp 4 delivers reasonable Java performance and marks a wide commitment by IBM to the Java platform on a variety of non-Windows architectures.—RVD

MACINTOSH

Running JMark on a Mac next to a 32-bit Windows system reveals the deficiencies in the Mac OS. The lack of thread support causes all sorts of problems. We tested Microsoft Internet Explorer 3.0a, Netscape Navigator 3.01, and Netscape Communicator, preview release 2, on the Mac OS. All of them suffered consistent visual problems or lockups.

JMark has 11 tests and displays the results of each in a scrolling list box as they complete. With each Mac browser, the display stopped updating after the list box was full. Every other platform scrolled the results as JMark entered them into the list. We suspect that Java really needs operating system threads to accomplish this, and the Mac does not provide them.

On the Graphics Threads test, both Netscape browsers took a relatively long time and then locked up right at the end, where the test cleans up all the threads it creates. IE 3.0a was able to perform the Graphics Threads test, but the threads in the test became badly out of sync. One last problem: On the AWT Blts & Images test, Navigator blurred the screen, but it did not actually display the images the test manipulates. This could indicate real-world

problems with animations and may translate into an unfair advantage on the product's score, which was middle-of-the-road on the Macintosh.

Performance on all three browsers was well below their Win32 counterparts, but IE 3.0a was fastest on the clear majority of the calculation-intensive tests.—LS

PERFORMANCE TESTS			
How We Tested			
 This chart indicates whether the specified Java virtual machine successfully loaded each application. We deemed the test unsuccessful if on loading the applet we experienced system locks or application errors that rendered the application nonfunctional.			
✓ Yes ✗ No	Applix Anyware Office	Corel Office for Java	EyeOpener
MICROSOFT WINDOWS 95			
HotJava Browser 1.0	✗	✗	✗
Lotus Notes 4.5	✗	✗	✗
Internet Explorer 3.01	✓	✓	✓
Internet Explorer 4 (beta 1.0)	✓	✓	✓
Communicator (PR2)	✓	✓	✓
Navigator 3.01	✓	✓	✓
MICROSOFT WINDOWS NT 4.0			
HotJava Browser 1.0	✗	✗	✗
Lotus Notes 4.5	✗	✗	✗
Internet Explorer 3.01	✓	✗	✗
Internet Explorer 4 (beta 1.0)	✗	✗	✗
Communicator (PR2)	✓	✗	✓
Navigator 3.01	✓	✓	✓
MICROSOFT WINDOWS 3.x			
Internet Explorer 3.01	✗	✗	✗
Communicator (PR2)	✗	✓	✗
OS/2			
Navigator 2.02	✓	✓	✓
MACINTOSH			
Internet Explorer 3.01	✗	✓	✓
Communicator (PR2)	✗	✗	✗
Navigator 3.01	✗	✓	✗
LINUX			
Communicator (PR2)	✗	✗	✗
Navigator 3.01	✗	✗	✗
JavaOS (SUN JAVASTATION)			
HotJava Browser (LAR)	✗	✓	✗

PR2—preview release 2 LAR—limited-access release

LINUX

Linux users have a choice of two browsers that support Java: Netscape Navigator 3.01 and Netscape Communicator, preview release 2. Microsoft has announced intentions to release Unix versions of Internet Explorer.

Working with Navigator was a struggle. We could not get the product to stay up for more than a few minutes when running Java, especially JMark. Although Netscape supports a variety of Unix oper-

ating systems, the company does not support its Linux version, so the results were not surprising.

Communicator was more reliable, but the results still do not make a strong argument for switching to Linux. It was able to get all the way through the tests, but the scores ranged from mediocre to poor.

Communicator's score on the Graphics Threads test was respectable, but not in Windows NT's class. The scores on AWT Graphics Mix and AWT Blts & Images were very good and outstanding, respectively. However, because the Linux driver for our video card could not support 24-bit color at 800-by-600 resolution, we tested at 16-bit color. Most other platforms, except the JavaStation, were tested at 24-bit color. We suspect this gave Communicator a boost on the AWT Graphics Mix, AWT Blts & Images, and Graphics Threads tests.—LS

SUN JAVASTATION

The Sun JavaStation takes the "virtual" out of *virtual machine*. The JavaStation is a dedicated Java system—that's all it runs natively. In order to run it and test it, though, we also had to set up a Sun Netra J server running Solaris, since the JavaStation reads JavaOS (its Java-based system software) from the server.

The JavaStation runs the HotJava Browser as its user interface. The version we tested was labeled "1.0 LAR," which stands for *Limited-Access Release*. All the system settings, including setting the resolution of the display, are handled through Web pages and HotJava menus. Our JavaStation was incapable of going beyond 8-bit color, which probably gave it an undue advantage on our JMark AWT Graphics Mix test and especially on the AWT Blts & Images test. (The other platforms, except Linux, were tested at 24-bit color.) The JavaStation tested had 64MB RAM and a 100-MHz MicroSparc II processor.

The JavaStation's performance was in the bottom tier of the systems we tested. For instance, it was almost always slower than all the Macintosh browsers. And in none of the computational tests did it come close to any of the mass-market Win32 VMs.—LS□



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Multiple Personalities

Today's groupware systems blend Internet openness with polished proprietary environments. By Tony Pompili

Choosing a groupware platform is like taking a Rorschach test: In both cases, no single ink blot or product looks the same to any two people. Some look at groupware and see mostly e-mail, while others describe it primarily as discussion forums. Still others identify groupware as a development platform for custom applications. But regardless of the type of application, all groupware systems these days show the unmistakable traits of Internet software and protocols.

The idea of groupware emerged several years ago with Lotus Notes: a powerful, enterprise-class system that provided a framework for sharing information. Lotus Notes soon saw competitors—Microsoft Exchange Server and Novell's GroupWise—and each

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solution was developed around proprietary directory services, document storage methods, and APIs. The groupware systems also developed all of the processes necessary to support this environment, such as mail routing, security, and replication. Most important, they developed clients that integrated their services. Furthermore, Lotus and Microsoft have built technologies into their groupware—such as OLE and ActiveX controls (formerly called OCXs, or OLE controls)—that are shared across the vendor's product lines.

But these proprietary clients and groupware services are being reconsidered in favor of open clients and Internet protocols. Companies have seen the simple beauty of using open, standards-based software for collaboration: Standards-based servers from various vendors can work with a variety of mail clients, news readers, and Web browsers in a seamless, interoperable environment. Since products are available from multiple vendors on virtually every operating system, companies aren't beholden to a single vendor and its development plans.

The term *intranet* was used to describe the first wave of Internet software deployment within companies. Today, many intranets are built around Web servers de-

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livering HTML pages, and all of the vendors in this roundup sell a Web server. (For a review of these and other Web server products, see the article "Beyond Unix" in this issue.) Now companies are seeing that the same benefits apply over the *extranet*, letting them share information with external partners over the Internet itself.

Netscape, prophet and proselytizer of the new Internet and intranet religion, began delivering standards-based products designed specifically for enterprise networks. Proprietary groupware vendors are following. Lotus, Microsoft, and Novell are playing catch-up in the Internet-standards race and have only recently begun to run neck-and-neck with Netscape.

A funny thing happened on the way to the industry-standard forum, though. While the traditional groupware vendors

have been furiously reeling in the Internet, Netscape has found it necessary to extend its offering with some features unavailable in ordinary, Internet-standards software, including its scheduling component and some of its discussion features. Microsoft, despite adding multiple Internet protocols to Exchange, has delivered Outlook 97, a client that runs only on Windows 95 or Windows NT and is designed to work hand-in-glove with Microsoft Office. Lotus—which now refers to its server as Domino and its client as Notes—is continuing to develop its client, and GroupWise has just revised its client for Windows 95 and Windows NT. To varying degrees, then, all the groupware systems today are a blend of proprietary functions and Internet standards. (For reviews of completely Internet-based collaboration products

HIGHLIGHTS

Groupware: Pick Your Protocol

Let there be no doubt: Groupware has now and forever adopted the Internet and its attendant protocols, standards, and software. The formerly proprietary systems have learned to speak to Internet clients using the lingua franca of HTML, POP3, NNTP, and other protocols. While today the usability of Internet software seems feeble compared with its proprietary counterparts, the obvious advantage of a standards-based collaborative environment is that it allows an effortless sharing of information, both within organizations and among them.

Simple standards, simple functionality E-mail, the most common groupware function, is matched fairly well by Internet software, especially with the remote-access awareness built into the new IMAP4 standard. Beyond e-mail, however, you'll find fewer rich features and less integration than exists in traditional groupware packages. Many Internet-based groupware applications tend to be based on static HTML, resulting in hard-to-use interfaces

Revenge of the "fat" client Despite the inevitable migration toward the Internet, groupware systems are teamed with proprietary clients that are the antithesis of the "thin" Internet client. The newly released Microsoft Outlook, for example, is a full-featured client for Exchange that is available only for Microsoft's 32-bit Windows platforms. Lotus Domino is still designed to provide the core of its groupware functionality via the Notes client. And the new Netscape Communicator Professional Edition, which started life as a simple Web browser, has gained weight over the years to include mail, a newsgroup reader, real-time conferencing, an IBM mainframe emulator, and a proprietary scheduling client.

Server-side story The server components must provide flexible and powerful management features. GroupWise and Exchange are well integrated into their respective operating-system platforms, providing good administration tools. On the other hand, neither of these products provides the extensive multiplatform

support of Domino or SuiteSpot. Domino does less at providing a cohesive management interface than allow Web-browser access to its management functions. Netscape provides good manageability servers through a browser (though at the time of testing the Calendar server still required a command-line interface and ran only on Solaris). Exchange 3.0 promises to make it easier to manage a large network with support for LDAP.

Craft your own groupware Groupware that runs quickly and is important to many groupware platforms is the ability to create customized applications. Domino excels in this area, providing integrated tools to help you translate almost any application into HTML. It also allows extensive customization but does not act as structured a framework as Domino. Down the road, programming standards such as Java and standard-based object components will make Internet applications much more customizable and integrated.

such as e-mail and Web groupware, see the following section, "Pure Intranets.")

In this roundup, we compare the proprietary and open features of the four leading groupware systems: Novell's GroupWise 5.1, Lotus Domino 4.5a, Microsoft Exchange Server 5.0, and Netscape SuiteSpot 2.02. In this review group, Domino and Exchange were the only products actually shipping. To compare these products' latest features, we looked at the beta version of GroupWise 5.1 and a mixture of beta and shipping components in Netscape's solution. We awarded our Editors' Choice to Lotus Domino, which offers the best of both worlds: It remains the most powerful proprietary groupware system, and it's also the most flexible product for creating Web applications.

THE INTERNET APPROACH

To understand each vendor's strategy for integrating the two classes of service—native and open—we tested these systems with their native clients and also with Internet clients wherever possible. Not surprisingly, e-mail continues to be groupware's focal point. E-mail is the most popular application within company networks, and the most popular Internet application next to Web browsing. On the proprietary side, Domino, Exchange, and GroupWise have robust, rich-text e-mail features. Integration with their directory services makes their e-mail easy to use within organizations. And with mail gateways, these systems let users send mail to other systems. Netscape offers rich text through e-mail with HTML as the document format.

On the Internet side, the way Netscape handles mail is a no-brainer: It uses native POP3 (Post Office Protocol) and IMAP4 (Internet Mail Access Protocol) mail formats and servers (see the glossary "The Building Blocks of Internet Messaging" for explanations of these and other protocols). Domino and Exchange also host POP3 servers, so any POP3 mail reader, such as Qualcomm's Eudora Pro, could use one of these servers just like any POP3 host. Optionally, Domino and Exchange

Editors' Choice

• Lotus Domino 4.5a



The multifaceted Lotus Domino and the Notes client team up to provide the most powerful and versatile groupware platform of any of the products

reviewed here. Lotus Domino, our Editors' Choice for groupware, retains the core strengths of the proprietary Notes system—including applications development, replication, and security—and adds Internet collaboration and publishing to its persona. One of the product's most appealing features is its ability to take any database and dynamically convert it into Web pages. No other product we've seen provides as painless a solution for developing Web-based groupware solutions.

But Lotus isn't neglecting the proprietary side of the house in its Internet campaign, adding Calendaring and Scheduling and making other improvements in Domino and Notes. Domino, together with Notes, remains the groupware leader.

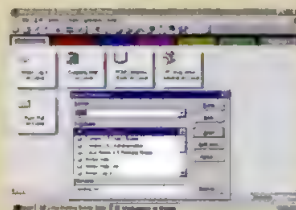
Like Lotus Domino, Microsoft Exchange Server has sprinted toward Internet protocols with support for POP3, NNTP, and LDAP in Version 5.0. Exchange also has an excellent Windows-based management interface and earns kudos with its new Outlook client. But Exchange is fit only for

organizations that are standardizing on servers and clients running 32-bit Windows operating systems.

Netscape SuiteSpot provides the most standards-based solution of this group. But SuiteSpot's features suffer compared with the power and integration built into its proprietary big brothers. We look forward to seeing a complete set of Netscape's servers in SuiteSpot 3.0, which promises better manageability and security.

GroupWise hasn't kept up as well with integrating Internet protocols but nevertheless provides a very good messaging and collaboration system particularly well suited for NetWare 4.x sites.

None of the Internet-based servers that we review in this story's second section comes close to matching the kind of powerful integration, flexibility, and customizability found in the four groupware systems in our main roundup. For standards-based groupware, we recommend that you consider SuiteSpot when Version 3.0 rolls out, or AltaVista Forum 2.0 for Web-based collaboration.



allow users to access mail from a Web browser. GroupWise, the farthest behind the Internet curve, allows Internet access to a mailbox only via a Web browser.

The invasion of Internet culture into corporations has brought with it real-time collaboration tools such as chat and electronic whiteboarding—functions not associated with traditional groupware. For a look at these products, see the sidebar "Real-Time Internet Collaboration."

Though messaging features are important, groupware covers more than basic e-

mail. Lotus and Microsoft attempt to use their Internet development environments to bring groupware applications to the browser. The leader of the pack is Domino, and Lotus's strategy is simple: Domino converts any database and applications into HTML on the fly. Any Notes database is viewable with a Web browser. Lotus hasn't quite achieved 100 percent fidelity between its Notes client and Web renderings—sometimes the HTML requires some tweaking—but the results are generally impressive and especially valuable for companies planning to extend existing Notes applications or information to the Web.

Microsoft is tying its Web strategy to ActiveX on the server and its Active Server Pages, which are HTML pages that include ActiveX scripting commands for

Our Contributors: PADRAIC BOYLE, JAN OZER, and TONY POMPILI are contributing editors of *PC Magazine*. BEN Z. GOTTESMAN is a technical director of PC Magazine Labs. ROBERT P. LIPSCHUTZ is the director of the Technology Center for Silicon Valley Internet Partners. TODD SPANGLER was the associate editor in charge of this story, and JEFFREY G. WITT was the project leader.

generating dynamic content. Out of the box, Microsoft Exchange utilizes an approach that is less customizable than Domino's, requiring ActiveX objects for each type of form or view in an Exchange database. For example, no ActiveX objects are available for Schedule+ and Outlook Calendar views, leaving these functions inaccessible from a browser. Microsoft's design requires you to develop an application once for its Outlook client and again for the Web, a more time-consuming approach than Lotus's.

Similar to Exchange, GroupWise in-

cludes a built-in library of objects for rendering a limited number of GroupWise elements (such as mail, calendar, and other documents) in HTML for Web browsers. GroupWise offers little customization in this Internet implementation, yet it's ready to go right out of the box, which is also one of GroupWise's most appealing attributes on the proprietary side.

Netscape, meanwhile, gears its groupware-application strategy around Web pages on its Enterprise Server. Though HTML pages can provide a simple level of integration (for example, you can embed

an e-mail link in a Web page) building more sophisticated applications—such as those you can create with Domino—requires more time and expertise.

UNDER THE HOOD

Server administration of these groupware systems is by and large complex and cumbersome, but some do it better than others. Exchange's Administration program provides an excellent interface with a hierarchical structure that displays all Exchange servers in your organization in one place. Similarly, Group-

The Building Blocks of Internet Messaging



IMAP4 (Internet Message Access Protocol, Version 4) A still-evolving protocol that allows a client to access and manipulate e-mail messages on a server.

IMAP4—designed for disconnected e-mail use—lets you perform such tasks as managing folders remotely, viewing just message subject lines, and selectively downloading messages and attachments based on various criteria (size or author, for example). IMAP4 also allows for shared mail folders.

MIME (Multipurpose Internet Mail Extensions) A standard for transmitting nontext e-mail message attachments via SMTP. Most proprietary mail systems must translate any received MIME attachments through an SMTP gateway.

NNTP (Network News Transfer Protocol) The protocol used by clients to post and retrieve messages to and from news servers, which host discussions. NNTP is also used by news servers to replicate newsgroup discussions.

POP3 (Post Office Protocol, Version 3) An established protocol that lets Internet users send and retrieve e-mail to and from mail servers. POP3 provides simple store-and-forward e-mail functionality, compared with the richer IMAP4 specification.

SMTP (Simple Mail Transfer Protocol) A standard protocol that defines how e-mail messages are transferred between servers. SMTP defines only ASCII text content, necessitating the MIME standard for nontext attachments.

Uuencode/uudecode Along with MIME, another common method of sending binary e-mail attachments as plain ASCII text.



HTML (HyperText Markup Language) The simple document-formatting language of the World Wide Web. Netscape and other vendors have begun using HTML as their standard for rich-text formatting across all Internet applications, such as e-mail and newsgroup messages.

HTTP (HyperText Transfer Protocol) The protocol that negotiates delivery of text and other elements from a Web server to a Web browser.

IIOB (Internet Inter-ORB Protocol) An evolving wire-level protocol that defines how distributed objects communicate with each other. IIOB—which is similar to Microsoft's Distributed Common Object Model (DCOM) specification—is based around the

Common Object Request Broker Architecture (CORBA). In theory, any IIOB-compliant client software on any platform will be able to access the same object, a programming function that performs a specific task (such as authenticating a user against a server).

LDAP (Lightweight Directory Access Protocol) An emerging directory service protocol that uses a subset of the X.500 directory standard to provide a common way to identify user and group information. It can be extended to provide information on other network resources.



S/MIME (Secure MIME) A public-key encryption protocol for securely sending MIME attachments.

SSL (Secure Sockets Layer) A protocol for sending encrypted information between a client and a server, often a Web server. SSL can work with any application-layer TCP/IP protocol and is most commonly used with HTTP.

X.509 certificates Digital-signature certificates that use public-key encryption for authenticating users. X.509 certificates can be issued by either a certificate authority (such as VeriSign) or an internal certificate server.

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3.5" floppy drive
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Tool-free minitower or desktop
Microsoft® Intellimouse, 104-key keyboard

Microsoft Windows® 95 and MS® Plus! CD
Microsoft Office 97 SBE CDs
Multimedia Xcitement Pak
(comprised of MMX technology-based software)
5-year/3-year limited Micron Power warranty

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12X SCSI CD-ROM drive, 3.5" floppy drive
100MB Iomega Zip drive

32 voice wavetable stereo sound and speakers
PCI 64-bit 3D video, MPEG, 4MB EDO RAM
Tool-free minitower or desktop
Microsoft Intellimouse, 104-key keyboard
Microsoft Windows 95 and MS Plus! CD

Microsoft Office 97 SBE CDs
Multimedia Xcitement Pak
(comprised of MMX technology-based software)
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Tool-free minitower or desktop
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Source: PC World best overall PC company for reliability and service, December 1996.

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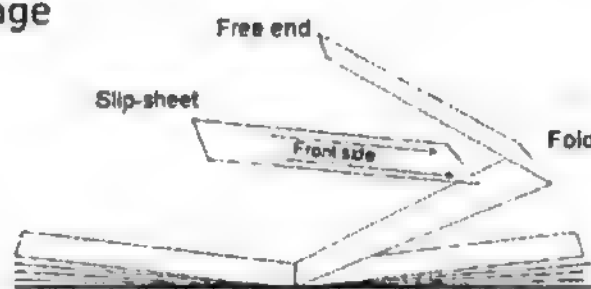
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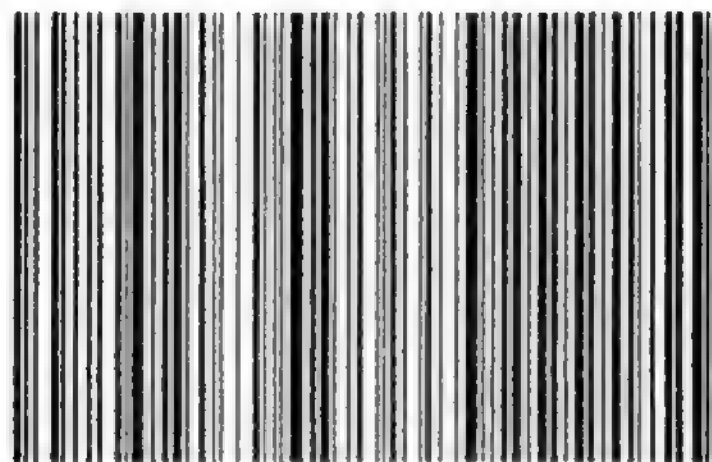
Memory. Video conferencing and whiteboard collaboration. MMX technology gives the entire system a boost in performance like never before.



1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



Inverted Foldout slip-sheet

Folded edge of the page

1. Open the foldout page

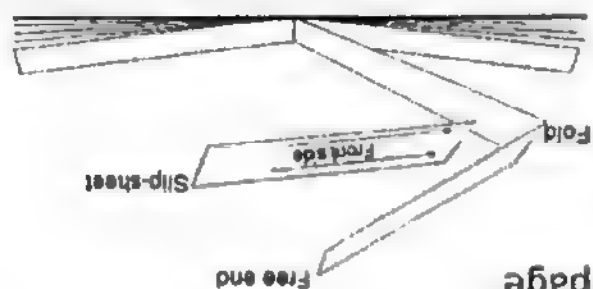
2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

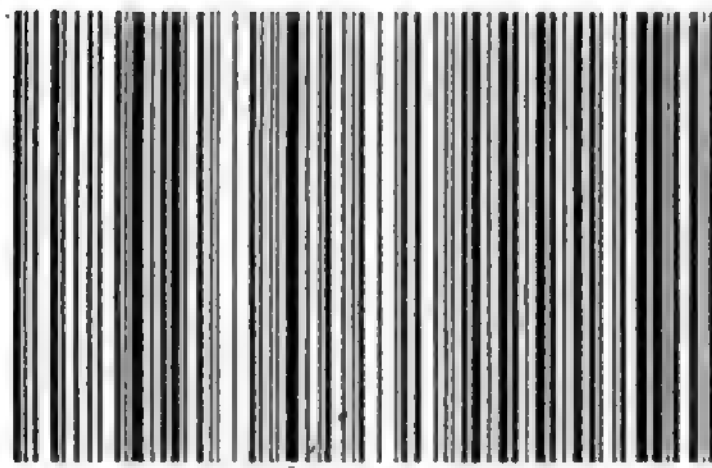
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlipBack-0018

Back

1. Follow instructions on the other side

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SELECT FEATURES

512KB pipeline burst cache, flash BIOS
12X EIDE CD-ROM drive
3.5" floppy drive
100MB Iomega Zip drive
32 voice wavetable stereo sound card with speakers
Advent A/270 2x25 watt stereo speakers in P200 only
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Tool-free mintower or desktop
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Microsoft Works CD

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Iomega Ditto 3200 (1.6/3.2GB) \$199
Travan tape backup drive with tape \$199
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SOFTWARE OPTIONS

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(available only on desktop and notebook systems with Windows 95)
Quicken Financial Pak: Quicken Deluxe, Quicken Financial Planner, Quicken Parents' Guide to Money, Quicken Family Lawyer \$69
(available only on desktop and notebook systems with Windows 95)

¹ Upgrade from systems with standard 16-bit stereo sound card
² Requires SCSI host adapter
Modern includes trial memberships to CompuServe and America Online
³ Modern includes trial memberships to CompuServe and America Online, requires sound card
⁴ Upgrade from systems with standard Micron 17" 17FGx color monitor

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- 24 hour technical support

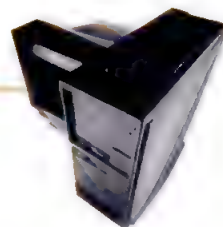
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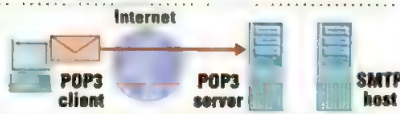
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How Internet Servers Work

POP3 MAIL

1. The POP3 client logs on to the POP3 server, sending any outgoing mail and attachments.



2. The server sends incoming messages to the POP3 client, then deletes them from the server.



3. The server sends outgoing messages to an SMTP host to be routed to their final destinations.

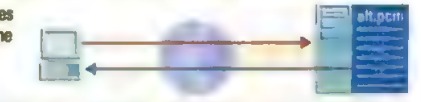


NNTP DISCUSSIONS

1. The client downloads the names of newly added groups hosted on the NNTP server.



2. When the user accesses a group, the server sends the client available message headings.



3. Message text and attachments are downloaded when the user clicks on a subject line.



IMAP4 MAIL

1. The IMAP4 client logs on to the server in either off-line, online, or disconnected mode.



2. In off-line mode, the IMAP4 client exchanges mail in the manner of a POP3 client.



3. In online mode, the IMAP4 server stores all messages, which the client downloads to view.



4. In disconnected mode, the client replicates the messages locally, synchronizing any changes.



WEB APPLICATIONS

1. The Web server sends the browser a requested page and any embedded graphics or objects.



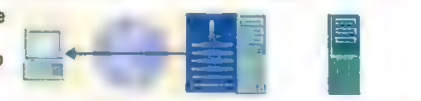
2. When a user submits form information (like a search query), it's sent back to the Web server.



3. The server processes the data, sending it to another application, such as a search engine.



4. The server formats the resulting data into an HTML page and sends it to the Web browser.



Wise offers a graphical console that snaps into NWAdmin, so performing management tasks will be familiar to NetWare administrators. Domino puts much of the administration functions in the Notes Address book, but other functions are scattered and at times counter-intuitive. Netscape uses a common interface via a Web browser but at present does not provide much integration among servers, requiring you to administer physically separate servers individually (a limitation that should be remedied with SuiteSpot 3.0).

Security features are integral to Domino, Exchange, and GroupWise. SuiteSpot lets you optionally use the certificate-based Secure Sockets Layer (SSL) standard for encryption and authentication, but not all of its servers support SSL yet. Of course, each of these vendors lets you optionally configure SSL for its Web server (see the

article "Beyond Unix" in this issue).

While Domino, Exchange, and GroupWise come with impressive, ready-to-use clients, some organizations need to develop custom groupware applications from the ground up. Lotus still leads in this area with its Integrated Development Environment (IDE) and Notes APIs for third-party development products. Exchange has a less integrated but still powerful visual development environment for Outlook that includes its streamlined VBScript language. Netscape offers no real applications development tools but, because of its open systems compatibility, claims to offer a platform for creating groupware applications using third-party products, such as Symantec's Visual Café. GroupWise is the least extensible of the products reviewed, with limited development capability on both the proprietary and Internet sides.

YOU MAKE THE CALL

Today, proprietary groupware provides more functionality than Internet-based implementations. Seasoned groupware products such as Lotus Domino and Microsoft Exchange deliver solid platforms for developing both conventional and Web applications. As Internet-based products like SuiteSpot mature, they will prove more alluring as preferred groupware platforms. Meanwhile, take a closer look at each of the four products in our roundup to help you decide which one looks the best for your organization.

Novell Inc.

GroupWise 5.1

BETA Novell's GroupWise 5.1 is a solid groupware platform that will fit best into existing NetWare shops looking for a package to pro-



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actually **change**
of computing?

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vide rich functionality—including solid document management—out of the box. GroupWise was among the first to provide access to e-mail via a Web browser, but it has quickly fallen behind the times in Internet integration. To its credit, Novell has rolled out IntranetWare, a bundle that includes NetWare 4.11, the Novell Web Server (reviewed in this issue's story "Beyond Unix"), and built-in TCP/IP support.

Released last September, Version 5 of GroupWise—called WordPerfect Office prior to its acquisition by Novell—represented a major overhaul of the program. As with Version 4.1, it had integrated e-mail, calendaring and scheduling, and task management. But

the new version added a client/server option, threaded discussions, and document management, as well as a completely revamped user interface. We looked at a late beta of Version 5.1, which addresses performance and scalability and provides some minor but useful enhancements to the client.

Using GroupWise in client/server mode requires TCP/IP on all workstations and servers. Unlike the other products here, however, GroupWise can still be used as a file-share mail system (Novell calls this Direct mode), where most of the work is performed at the client. The client/server option should provide improved scalability, but smaller organizations and those not

ready to implement TCP/IP will prefer Direct mode. GroupWise allows both methods to be used simultaneously, as an organization deems appropriate.

Lotus, Microsoft, and Netscape now position their products as Internet-ready for access to open clients, but Novell doesn't provide nearly the same level of access with GroupWise. GroupWise WebAccess lets users check their e-mail and calendars, send messages, and schedule appointments, all through a Web browser. All info is presented as straight HTML, which proves to be inefficient. Also, users can't access shared folders or documents in folders via a browser, nor can they schedule personal appointments. Novell has a new version of Group-

Future Groupware Directions

Groupware will continue to evolve as packages enhance their capabilities. Here's a summary of what to expect this year.

GROUPWISE

Novell previewed the next version of WebAccess for us, to be available mid-year. The new version will use frames and JavaScript to present user info more efficiently in a browser. When it ships, GroupWise 5.1 will add the ability to access LDAP directories from the GroupWise client via third-party MAPI providers such as Nexor and Boldon James Limited. A major upgrade will include native POP3, IMAP4, and LDAP support in the server and should also be available midyear.

GroupWise WorkFlow, which provides graphical workflow development and tracking, and GroupWise Imaging, which extends the program's document management to scanning and viewing image documents, should be available midyear.

LOTUS DOMINO

Watch for a new Notes client from Lotus—code-named Lookout—that will be available by midyear. Lookout, a client for Windows 95 and Windows NT, will let you create a "portfolio" of Domino databases, across which you can execute a full-text search. You will

be able to use Word or WordPro as your message editor instead of the Notes editor, and Lotus plans to make the Microsoft Internet Explorer ActiveX control available as a replacement for the Notes browser. Another client release, code-named Maui, will provide a client similar to Lookout for Windows 3.x, Macintosh, and Unix.

Lotus also plans to roll out a full Web design client based on NetObjects' Fusion for building Domino applications for the Web. (IBM, Lotus's parent company, recently announced plans to acquire a majority stake in NetObjects.) Lotus will use IIOP to create more robust Web applications. Domino is scheduled to include an NNTP server in a release later this year.

MICROSOFT EXCHANGE

Microsoft is planning relatively modest Exchange enhancements in the coming year. New calendar objects are expected to allow browser users accessing Exchange to be able to render Outlook Calendar views and events. On the Internet side, Outlook will support HTML natively and include an integrated LDAP client.

NETSCAPE SUITESPOT

SuiteSpot 3.0, which will ship piecemeal over the first half of 1997, will let administrators choose whether to manage

users and groups on separate servers or centrally using Directory Server. Each of the SuiteSpot servers will be extensible through Internet Foundation Classes (IFCs), which let developers access server functions using Java and JavaScript. SuiteSpot 3.0 will include improved end-user publishing and content management tools for Enterprise Server, and the ability for users to add newsgroups to Collabra servers.

In addition to updated versions of the current servers—including Messaging Server 3.0, a replacement for Mail Server 2.0—SuiteSpot 3.0 will include two new family members: Netscape Media Server 1.0 will stream audio and video files to clients equipped with the Media Player plug-in, and Catalog Server 1.0 will provide a search engine to query across multiple Web servers.

Netscape's Constellation desktop environment—slated for year-end delivery—uses push technology to replicate Web site information and provide location-independent access to SuiteSpot by storing all user information and files on servers.

Finally, Netscape and Novell recently announced the joint formation of Novonyx, a company that will port SuiteSpot servers to NetWare. The first of these will be Netscape Enterprise and FastTrack Web servers, expected by the end of this year.

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Survey by Ernst & Young

Introducing McAfee Desktop Security Suite. The first total desktop protection all in one box.

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It's a big problem, especially since desktop threats are as varied as they are expensive. Over 200 new viruses appear each month. Outside hackers are becoming more skilled at gaining access. According to the FBI, your own employees are responsible for 50% of all network intrusions. And disasters such as system crashes are completely unpredictable.

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HOW WE TESTED

How We Evaluated Groupware



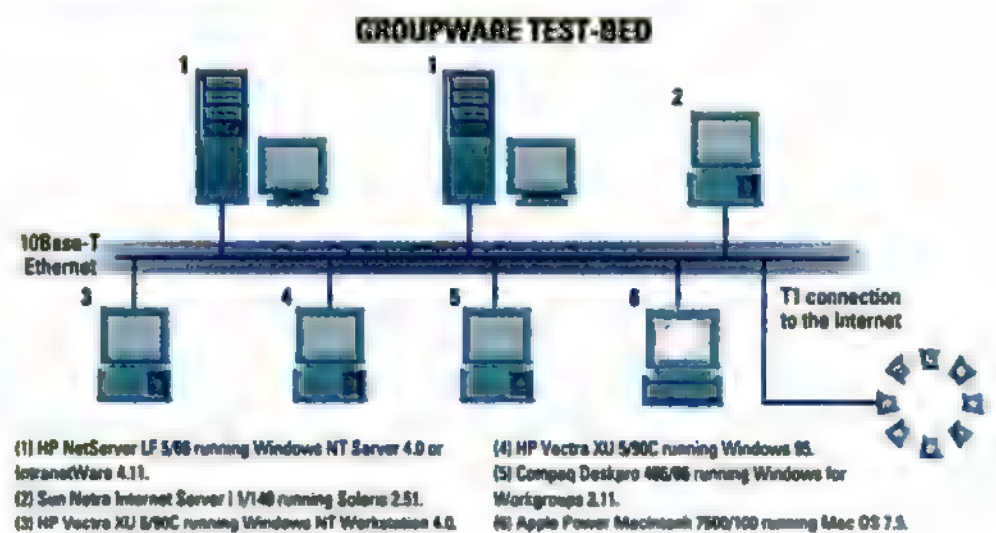
We tested Novell's GroupWise, Lotus Domino, Microsoft Exchange, and Netscape SuiteSpot with both native clients and Internet clients on multiple operating systems to compare how well the systems worked with each client group.

We loaded each vendor's groupware server software on Microsoft Windows NT Server 4.0, with the exception of Novell's GroupWise 5.1, which we installed on NetWare 4.11. We set up each groupware vendor's native 16- and 32-bit Windows client software on our network. To test open-client capabilities, we used (on multiple client platforms) Netscape Navigator 3.0 and Microsoft Internet Explorer 3.0 browsers, and Qualcomm's Eudora Pro 3.0, a POP3-compliant mail client. We configured the clients to use their operating system's native TCP/IP protocol, with the exception of our Windows for Workgroup 3.11 client, for which we used NetManage's Chameleon 6.0 stack.

We used each system's proprietary and standards-based methods to manage the systems locally and across the network. Where necessary, we installed optional Internet protocols or gateways. We synchronized data stores across our two test servers, using any scheduling options available. For each client type we performed basic e-mail tasks and scheduled appointments, looking for notification and time-conflict resolution features. Our evaluation of discussion groups considered posting, editing, and levels of threading. We tested any built-in remote-access features included with the proprietary client,

such as integrated dial-up software, comparing how well each product handled off-line support.

To test each groupware system's applications development capabilities, we created a specification for a simple project-planning application. We then asked each vendor to build the application in our Labs within a 4-hour period; we allowed the vendors to use both their own and commercially available tools. The application consisted of a main form that included a list of team members gathered from a public address book. We specified that the application include tools for online discussion, task assignment, and meeting and resource scheduling. We asked that the information be viewable by the clients by project type and all discussion, task, and files relating to the project. For all task assignments and meeting scheduling, we required that the system send an e-mail notification. To examine security, we required the system to ensure that only members of a project be able to read and edit information relating to the project.—Jeffrey G. Witt



Wise planned that will extend the product's Internet features (see the sidebar below).

MADE FOR NETWARE

With Version 5.x, GroupWise uses the Novell Directory Services (NDS) database as its master directory. All administration is performed within the NetWare Administrator program, known as NWAdmin. When you install GroupWise, it extends NDS to include several GroupWise-specific objects (such as domains, post offices, gateways, and scheduling resources) and modifies the standard user record to include GroupWise information.

Because NDS currently runs only on NetWare 4.x, GroupWise requires at least one NetWare 4.x server. (Novell is currently porting NDS to Windows NT, scheduled to be available later this year.) Three server-based agents handle most of GroupWise's work: the Message Transfer Agent (MTA), which moves messages between domains, post offices, and gateways;

the Administration Agent (ADA), which takes information from NDS and puts it into the GroupWise address book; and the Post Office Agent (POA), which handles the actual delivery of messages and other items to the in-box. Versions of the agents are available for both NetWare 3.1x and 4.x and Windows NT 3.51 or later. Unlike Exchange and Domino agents, though, the GroupWise NT agents are not integrated with the Windows NT architecture. But GroupWise, like Exchange and Domino, does include integrated authentication and security features.

Shared folders are the only items that are replicated among servers (besides NDS information). A replica of a shared folder is created automatically at the post office of each participant. Messages take explicit routes between post offices. The system has no concept of least-cost or fail-safe routing, as Lotus Domino does. If a server along the route is down, GroupWise will hold messages until the connection is reestablished.

The 32-bit GroupWise 5.x client for Windows 95 and Windows NT is significantly changed from the Version 4.1 client. The program now sports the much more standard, two-paned (folders on the left, messages on the right) or three-paned (message preview at the bottom) interface. All features—mail, calendar, and discussions—are accessible within the same client. The interface for the Windows 3.x client has not changed, but behind the scenes it has been updated to support client/server mode (though it doesn't support GroupWise's shared folders or document management features). Updated Macintosh and Unix clients are in the works, but they aren't available yet.

Though GroupWise mail now supports rich text, it has no paragraph layout controls. Files and OLE objects can be included as separate attachments, but not inline with message text. Mail can also be accessed from any MAPI-compliant client. We were especially impressed with Group-



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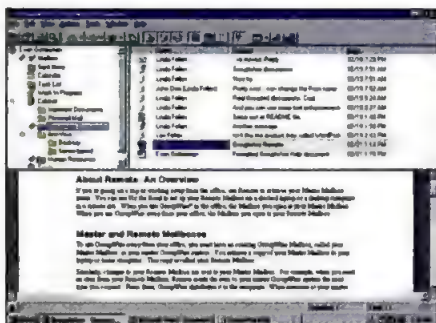
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GroupWise 5.x's new client has a polished three-pane interface.

Wise's message-tracking capabilities. A user can see when a message was delivered or if it has been read and can also retract a sent message that hasn't been read. Users can also assign others to their mailboxes, letting them read and write mail.

A STRONG GROUPWARE CORE

GroupWise includes a robust group-scheduling application with all the features one would expect, including free-time search

and resource management. The basic calendar views are somewhat limited; for example, you can't view schedules by month. Additional views showing various numbers of days in different layouts are available but are less tightly integrated. GroupWise also lets users manage personal tasks and tasks for others.

Shared folders, new to GroupWise 5.x, provide a repository where multiple users can have discussions or store items relevant to the group (although you can't grant access to groups, just individuals). You can view the contents of GroupWise folders as a list or in a threaded manner for discussions. Any user can create a shared folder and decide who can read, edit, and delete messages in the folder. When the folder is created, a mail notification goes out to each user who has been given access. When the user reads the notice, a Wizard is automatically launched, which walks through adding the folder to the client.

Novell has integrated document management software—formerly sold as Nov-

ell's SoftSolutions—into GroupWise 5.x, a feature unique among the products reviewed here. With minimal additional administration on the part of the user, GroupWise provides robust document management functionality—including access control, versioning, check-in/check-out, and tight application integration. Documents are stored in libraries that can reside at the post office or on dedicated servers.

GroupWise has an easy-to-use and powerful server-based rules engine that allows users to define what actions should be performed on messages based on their type and content. In addition, the program's Find capability can search across multiple folders for items that meet simple or complex query parameters. The results of the find can then be stored as a Query Folder (somewhat akin to a private view in Lotus Notes). Unfortunately, users can't distribute useful rules to others, and Query Folders can't be shared.

Like the Notes and Exchange clients,

GROUPWARE

How to Read the Suitability to Task Boxes

We evaluate these groupware systems using dual ratings, comparing both the features provided with each product's *native client* and the features the product offers via an *open client* (any Internet-standards-based software) wherever possible. We compare ratings across products to illustrate each groupware system's benefits and drawbacks clearly.

Administration We examine the ease of installation and management of the system across multiple servers. The system must allow remote administration from anywhere on the network. The system should share user and group information among its modules to allow the administrator to make changes and implement security easily. We give higher grades to products that integrate with the network operating system or public directories, such as those that use LDAP. We prefer systems that allow data synchronization between servers and offer encryption. We also like migration tools to move user information and data from existing systems.

Messaging We look at standard client e-mail features including text-formatting capabilities, delivery options, attachment support, and user-configurable views. On the server, we expect a single message

SUITABILITY TO TASK		
Product Name		
	Native client	Open client
Administration	Poor	Poor
Messaging	Fair	Fair
Collaboration	Good	Good
Scheduling	Excellent	Excellent
Applications development	Excellent	Excellent

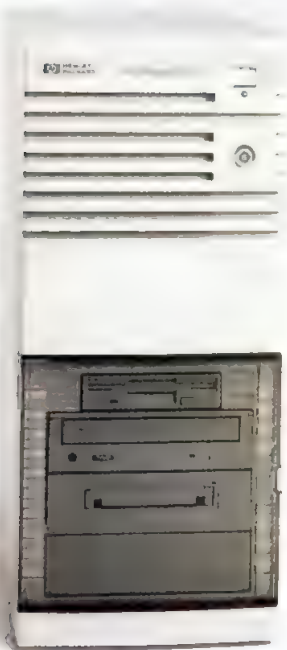
store, support for multiple directories, and robust routing features. We give better ratings to products that integrate e-mail with discussion and scheduling modules. We explore whether the system handles HTML and MIME formats, and POP3 and SMTP protocols natively or through translation gateways.

Collaboration We mainly consider discussion groups, rating the ease of posting and editing messages as well as attaching documents. We like the ability to collapse threads for easy navigation and readability, and require a visual indication of which messages have been read and those that are unread. We also look for multiple ways of viewing the information (for example, by user, date, or topic). Products should contain moderator and security features. The best systems include strong search tools. Products

with a built-in NNTP interface allow interoperability with Internet newsgroup readers.

Scheduling We want scheduling features for users, groups, and resources that provide time-conflict resolution, free-time searches, and creation of recurring events. We give higher scores to products that include strong notification features integrated with e-mail. The scheduler module should share address books with other groupware modules, and we favor products that can communicate with public directories as well.

Applications development We evaluate the tools for customizing groupware environments for made-to-order applications. We favor products that include forms designing and scripting tools. Developers need the ability to access the groupware data stores as well as access external database formats easily. Our highest rankings go to products that make all groupware module functions available in both native and open formats, such as HTML. The product's architecture should require minimal or no additional work to develop applications for both native and open environments. We look for development capabilities that allow tight interrelationships of all groupware functions.



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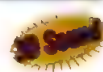
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the same GroupWise client is used for server and remote access. The client automatically senses whether the network is present and decides whether to use the network message store or local copy. To

SUITABILITY TO TASK		
GroupWise		
	Native client	Open client
Administration	Good	N/A
Messaging	Good	Fair
Collaboration	Good	N/A
Scheduling	Good	Poor
Applications development	Fair	N/A

N/A—Not applicable: The product does not have this feature.

keep the local store compact, the user can define specific subsets to take.

GroupWise does not provide any applications development tools similar to LotusScript or VBScript. But developers can extend the program using the GroupWise Object API and Custom 3rd Party Objects (C3PO) Manager in conjunction with popular development tools such as Microsoft Visual Basic and Borland's Delphi. The program still supports InForms for customized forms, although they show up only as attachments.—Ben Z. Gottesman

GroupWise 5.1. List price: 100-user license, \$13,340. Novell Inc., Orem, UT; 800-638-9273, 801-226-6000; www.novell.com. Circle 441 on reader service card.

Lotus Development Corp.

Lotus Domino 4.5a



No matter what you're looking for in a groupware solution, you'll find it in Lotus Domino 4.5a. The combination of Domino's new native server support for POP3 mail, direct Web browsing from within the Notes 4.5 client, and the traditional Notes offerings makes Lotus's flagship product even more appealing. Lotus Domino 4.5a—our Editors' Choice for groupware—is an enticing system both for organizations building traditional, heavy-duty groupware environments and for those just beginning with groupware in their evolving intranets.

Version 4.5a delivers a variety of popular Internet services with its POP3, SMTP, and HTTP servers, building on the powerful features of Notes' popular information-sharing environment. But in its zeal to produce an appealing Internet product, Lotus

SUMMARY OF FEATURES

Continues

Groupware

BETA

PC MAGAZINE
EDITORS' CHOICE

BETA

■ YES ■ NO

Products listed in alphabetical order

	GroupWise 5.1	Lotus Domino 4.5a	Microsoft Exchange Server 5.0	Netscape SuiteSpot 2.02
List price per server	Not priced per server	\$2,995 (multi-processor server edition)	Not priced per server	\$4,995 (includes five servers of your choice)
List price, 100-user license	\$13,340	\$6,900 (Notes Desktop client)	\$6,143 (standard server)	\$7,995

Clients

Native client available for:

Microsoft Windows 3.x/95/
NT Workstation 4.0

Macintosh, OS/2 Warp, Unix

Native client includes integrated:

Web browser

Newsgroup reader

POP3/IMAP4 e-mail reader

User can access e-mail/discussions using a Web browser

Servers

Operating systems supported:

Microsoft Windows NT Server 3.51/4.0

NetWare 3.1x/4.11

OS/2 Warp Server 4

AIX

HP-UX

Solaris

Server or bundle includes:

Web server or equivalent HTTP services

Newsgroup server or equivalent NNTP services

POP3/IMAP4 server or equivalent services

Internet protocols supported by servers:

Lightweight Directory Access Protocol (LDAP)

Secure Sockets Layer (SSL) 2.0/3.0

Simple Mail Transfer Protocol (SMTP)

Network protocols supported by servers:

TCP/IP

IPX/SPX

NetBIOS and NetBEUI

Other

None

AppleTalk, SNA, VINES

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

None

Messaging

Native client's single in-box view can include:

E-mail messages/Voice mail/Faxes

Calendar events/Tasks

Native client's e-mail contents can include in-line:

Rich text/Graphics/Forms

Clickable URL links/OLE 2.0 objects

Server supports MIME/S-MIME attachments

Server supports uuencode attachments

Administrator can customize forms

User can customize forms

User can set server/client-based rules

(in remote-access mode)

User can delegate access to a private mailbox

User can view delivery route

Native client allows LDAP address lookups

Collaboration

Threaded discussions to second level

Threaded discussions to infinite levels

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Free Virus Updates	Yes	No

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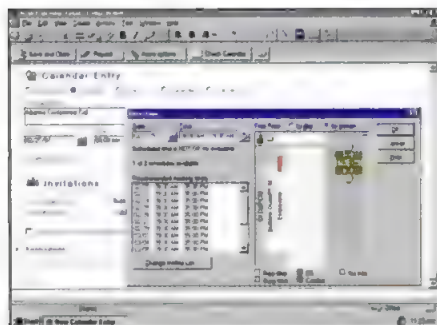
isn't leaving its traditional groupware customers in the lurch. Recently, Lotus introduced Calendaring and Scheduling (C&S) and a variety of useful server improvements that continue to make Notes strong functionally and architecturally.

WHAT'S IN A NAME?

In Lotus's renamed product family, "Notes" now refers only to the Notes client, which provides an interface and access to databases, mail, and development tools. The Notes client comes in three flavors: the full client (\$275 per user), which includes applications development tools; Notes Desktop (\$69 per user), which provides all features except the development tools; and Notes Mail (\$55 per user), which provides e-mail and access to basic databases.

Domino is a collection of server processes, including database replicating, mail routing, and indexing. Domino also hosts the Domino Web Server, POP3 server, and SMTP Message Transfer Agent. These are managed from a single server console. In keeping with its cross-platform tradition, Domino is also available for a variety of Unix servers—including AIX, HP-UX, and Solaris—and for OS/2 and NetWare.

At Domino's core are Lotus's original strengths: a rich-text, document-oriented, flat-file message store, with multiprotocol



The new Notes Calendaring and Scheduling client has a Lotus Organizer-like interface.

database replication and integrated applications development tools. Lotus's strategy with Domino is to take Notes views, forms, and documents—central Notes application parts—and convert them to HTML on the fly. Domino doesn't translate everything perfectly, so applications might require some manual tweaking. Nonetheless, Domino allows any user with a Web browser to access these applications, which can be built around any Domino database. This

SUMMARY OF FEATURES

Ends

Groupware

BETA

PC MAGAZINE
EDITORS' CHOICE

BETA

GroupWise 5.1

Lotus
Domino 4.5a

Microsoft
Exchange
Server 5.0

Netscape
SuiteSpot 2.02

Collaboration (continued)

Moderated discussions				
Types of searches:				
Boolean				
By data store/topic/full text				
Agents can be created to search for specific topics				
Discussion documents can include in-line:				
Rich text/Graphics/Forms				
Clickable URL links/OLE 2.0 objects				

Scheduling

Scheduler allows user to:				
View schedule by day/week/month		(two-day view)		
View schedule by users/groups				
Schedule groups/resources				
Create links to e-mail/documents				
Create links to discussions				
Task scheduling				
Searches for free time slots of invitees				

Synchronization

Servers can synchronize message/calendar/documents	N/A N/A			
Clients can replicate message/calendar				
Clients can replicate documents				
Supports synchronization at folder/document/field level				
Administrator can schedule server synchronization				
Client synchronization can operate bidirectionally/in background				

Applications Development

Includes an integrated forms designer/full development environment				
Development tools	None	LotusScript 3.0	Exchange Forms Designer, Outlook Forms Designer	LiveWire Pro
Tools sold separately from vendor				
Tools sold separately from third-party vendor				
APIs supported:				
MAPI/VIM/Common Messaging Calls (CMC)				
Internet Inter-ORB Object Protocol (IIOP)				
Distributed Common Object Model (DCOM)				
TAPI/TSAPI				
OLE 2.0				
Provides native database support for:				
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Sybase SQL Server				

Other Integrated Functions

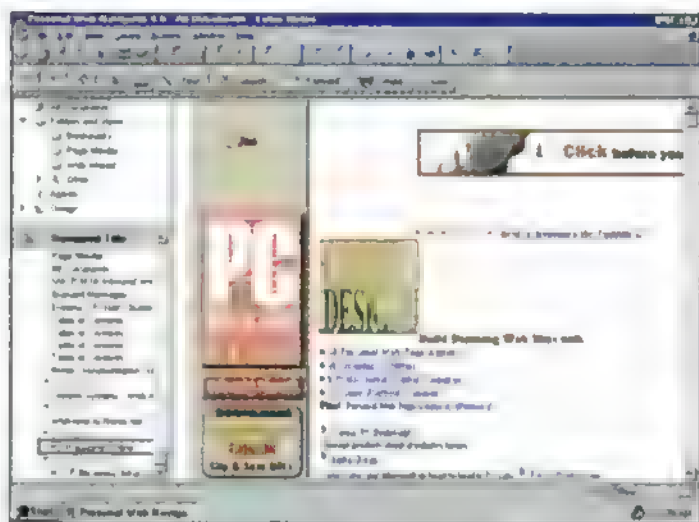
Workflow:				
Sequential/parallel flows				
Author-tracking				
Saving of defined workflows				
Document management:				
Check-in and check-out				
Concurrency control/versioning				

N/A—Not applicable: Message and calendar stores are kept only at the user's post-office server.

differs from the approach of Netscape SuiteSpot, which uses a separate server type for each function—for example, an NNTP news server for discussions and a POP3 server for mail.

To be fair, using native POP3 is more efficient than having to render HTML for all of your mail functions. Luckily, Domino gives you both options. The Domino POP3 server is easy to set up, with step-by-step instructions and information about configuring specific e-mail clients such as Netscape Navigator or Eudora. You configure both the SMTP MTA and the POP3 server using familiar Notes address-book documents, making it simple for Notes administrators to add Internet-standard services on top of their normal Notes administration tasks.

We were impressed with how well Domino's Internet and proprietary features worked together. With previous versions of Notes, accessing the Web from the Notes client required you to run the InterNotes proxy server. Now Notes 4.5 can access the Web directly. We found the Notes browser to be slower and less accurate in its rendering than Microsoft Internet Explorer 3.0 or Netscape Navigator 3.0 (included with Notes 4.5 clients), but the native Notes browser lets you store Web pages in shared databases.



The Notes 4.5 client can store HTML pages in individual or shared databases.

DELIVERING THE MAIL—ANYWHERE

E-mail is still a central Domino and Notes function, just as it is with Exchange and GroupWise. In a Notes mail message you can include rich text, OLE objects, and Notes Component objects (Lotus's ActiveX applets). The Notes interface is somewhat limited compared with Outlook's, but it's still more powerful and flexible than any POP3 or IMAP4 client we've seen. Like every-

thing in Domino and Notes, mail forms are completely customizable, allowing companies to create mail interfaces outfitted with the buttons and automation macros that best fit their needs.

On the Internet side, as mentioned, Notes mail can be made available to Web browser users. While Web browser users can't use Notes' certificate-based security, they can use simple user-name/password log-ons or—optionally, as with any other Domino HTTP application—use Secure Sockets Layer (SSL) for encryption. Notes developers can use the traditional Access Control List (ACL) to add Web users to mail and other database applications in the same manner as Notes users.

Calendaring and Scheduling makes an impressive debut in Version 4.5. Taking a cue from Lotus Organizer, Domino's C&S offers intuitive features that include letting you drag and drop to reschedule meetings or tasks. Your calendar can be viewed in two-day, weekly, biweekly, or monthly formats. These special calendar views are now part of the Notes programming tools, so you can even use these views in non-C&S applications. Of course, one of the best features of C&S is that it lets you check other users' schedules when you make a meeting request. A server process called Free Time Lookup checks Notes 4.5 users' schedules for you and returns free and busy times. Users of older Notes clients, though, cannot use C&S (unless they access it through a Web browser).

Notes continues to offer one of the most flexible remote-access models of all products tested here. Mail and other databases can be replicated locally, making it simple to work off-line. Selective Replication, while sometimes confusing to set up, lets you limit which documents are replicated, minimizing connect time. Notes has its own built-in dial-up function but can also be replicated across networks, including the Internet. A visual Replicator lets you specify for each database how and when to replicate automatically. At the time we reviewed the products, Lotus was beta-testing Weblicator, an off-line browser that applies

Notes-like scheduled replication to Web sites and Domino Web applications.

BUILDING APPLICATIONS

On the development side, Domino provides its integrated development environment for creating forms and views and developing automation code. This code can be developed with LotusScript, which is a BASIC-like scripting language, or with Notes' older and simpler @Function and @Command macro environment. For developers using third-party tools

such as Visual Basic, Notes APIs give access to database functions. Notes even offers a set of higher-level development tools, called HiTest, to give third-party products

SUITABILITY TO TASK		
Lotus Domino		
	Native client	Open client
Administration	Good	Good
Messaging	Excellent	Good
Collaboration	Excellent	Excellent
Scheduling	Good	Good
Applications development	Excellent	Good

easier access to Notes underpinnings.

Notes supports ActiveX objects, including a line of enhanced ActiveX applets called Lotus Components. ActiveX applets can be included in Notes forms or called by LotusScript, which offers even greater programming flexibility.

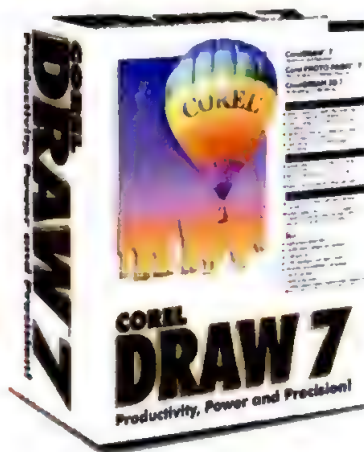
Under the hood, Lotus has tried to improve administration, a historically weak area of Domino and Notes. In large environments, Notes continues to be a mammoth application to manage. Though Lotus's designers tried to consolidate much of the administration around the address book, related elements such as connection records, server records, and ports are still scattered. The new Master Address Book now lets administrators build and maintain a single database of address books (though Domino still maintains a proprietary directory). But administration could stand to be cleaned up: Domino's server console has a kludge of a text-based interface, and administrative functions are spattered throughout the client and address book. Microsoft Exchange does a better job with its hierarchical administration database.

—Tony Pompili

Lotus Domino 4.5a. List price: single-processor version, \$995 per server; multiprocessor version, \$2,995 per server; \$55 to \$275 per client. Lotus Development Corp., Cambridge, MA; 800-346-1305, 617-577-8500; www.lotus.com. *Circle 442 on reader service card.*

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- Throughout CorelDRAW 7, you'll find impressive new ease of use enhancements.
- Graphics artists who want a well-rounded suite should give CorelDRAW a close look.
- CorelDRAW 7 is a full-featured graphics suite with state-of-the-art tools.

Windows Sources, January 1997

- Draw 7 will be an excellent choice for any Web page designer. . . . Draw 7 represents a real leap forward. . . . Draw users will cheer. But I think the real story about Draw 7 is its accessibility to new users. If you've never used an illustration app before, Draw 7 makes it easy.

Government Computer News,
November 1996

- Graphics professionals, take note: if you have the power, Corel has the program. CorelDRAW 7 is a feature-packed behemoth with something to please professional illustrators, graphic artists, and desktop publishers alike.

C/Net.com, November 11, 1996

CorelDRAW 7 is the most stable and well-developed version of the program yet. Corel has taken the strongest elements from previous versions—CorelDRAW, Corel PHOTO-PAINT, and CorelDREAM 3D—and made them easier to use, more reliable, and more unified as a suite.

PC Graphics & Video, December 1996

At this point, no other graphics program offers the breadth of features or comprehensive automation capabilities found in CorelDraw 7 Graphics Suite.

PC Magazine, February 18, 1997

For the first time in several years, CorelDraw's interface has changed significantly, yielding such innovations as a context-sensitive toolbar that alters according to the drawing tool you're using.

PC World, January 1997



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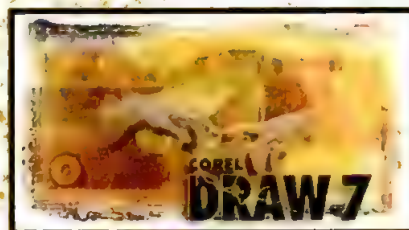


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Microsoft Corp.

Microsoft Exchange Server 5.0

Microsoft Exchange Server 5.0 and its newest client, Microsoft Outlook 97, are looking more appealing for companies standardizing on Microsoft Corp.'s 32-bit Windows client and server operating systems. If you don't plan to construct your messaging system around Windows NT Server, though, Exchange will not make the grade. Teamed with Outlook, Exchange offers impressive integrated messaging, calendaring, and information management features. But Exchange isn't planning on getting swallowed up in some proprietary tar pit: This newest version of Exchange is rich with Internet-standard services, including an NNTP newsgroup server, a directory based on the Lightweight Directory Access Protocol (LDAP), and a POP3 mail server.

Part of the Microsoft BackOffice family of products, Exchange Server is tightly integrated into Windows NT Server. Designed as a powerful client/server messaging system, Exchange is Microsoft's core application for providing groupware services for both its proprietary line of clients and its standards-based intranet clients. Based on the Messaging Application Program Interface (MAPI), Exchange Server acts as the message and document storage system for the various new Internet services. Exchange's integration with Windows NT Server makes it simple to manage its NNTP server, LDAP directory, and POP3 server, as well as the new Internet Mail Services SMTP server.

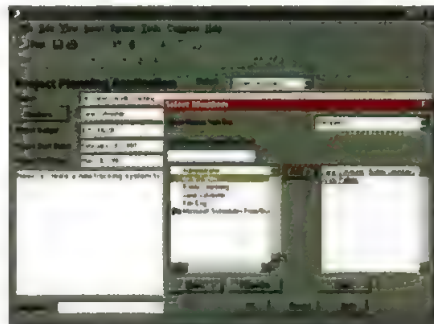
On the client side, the new Outlook client is an attractive replacement for the Exchange client. Microsoft has delivered an easy-to-use interface for managing messaging, public databases, calendaring, and a variety of other tasks. Unfortunately, Outlook runs only under Windows 95 and Windows NT. Microsoft still includes the Exchange client, however, for Windows 3.x and Macintosh users.

UNITY WITH WINDOWS NT

Exchange ties neatly into the Windows NT Server architecture. With Exchange installed, you can simultaneously create new Exchange and Windows NT user accounts. Similarly, because Exchange relies on

Windows NT's security, users need only log in once to a Windows NT domain to access their Exchange accounts. Exchange shares other Windows NT services, such as the Event Viewer, which allows Exchange to log its errors in a single database with those of other Windows NT applications.

The new Internet services in Exchange 5.0 also take advantage of this intimate relationship with Windows NT. It's a real advantage to have access to the Microsoft Internet Information Server and Windows NT's Domain Name Service (DNS) server, standard applications that ship with Windows NT Server.



Microsoft Outlook integrates messaging and scheduling into its powerful interface.

As Exchange Server integrates tightly with Windows NT, the new Internet services fit tightly into Exchange's hierarchical database structure. The Exchange directory, for example, includes support for the LDAP directory, allowing any LDAP client to access it. Exchange has one of the most intuitive management architectures of all the products reviewed here. The Exchange Administration Program lets you organize services and users in a single enterprise-wide tree, similar to Novell's hierarchical directory service, NDS. We found this graphical tree structure useful for managing our test servers and more effective than the nonhierarchical name-and-address book design found in Lotus Domino. But, unlike in Domino or SuiteSpot, you cannot manage Exchange via a Web browser.

Exchange's message and data store remains relatively monolithic. The Exchange server stores all the mail folders of

a site's users in a single database and all of the public folders in another. Domino, on the other hand, stores each user's mail as a separate file. Right now, Exchange databases can be as large as 16GB each, and Microsoft intends to increase this ceiling, bringing it somewhere close to 16 terabytes by the end of the year.

FRESH OUTLOOK

New to this version is the Outlook client. Shipping with both Exchange Server 5.0 and Microsoft Office 97, Outlook is an integrated messaging, calendaring, contact, and task management application that can operate either standalone or networked. Like the previous Exchange client, Outlook can access a variety of MAPI-based and other mail systems, including CompuServe, Lotus cc:Mail, and Microsoft Mail, though it is clearly tuned for Exchange.

Outlook features an intuitive interface for locating and reusing information. For example, you can use a smartly designed contact form to record a contact's name, address, phone number, and other personal information with the Contact tool. You can drag the contact's name onto the Inbox icon and a new mail message will be created automatically. Outlook's excellent use of drag-and-drop is especially helpful when you are customizing views. By clicking on a column heading, you can reorder, sort, and even categorize views.

Outlook lets users launch a Web page from within its tools. It recognizes URLs in text, and clicking on a link launches your Web browser. Optionally, you can install the ActiveX version of Microsoft Internet Explorer as part of Outlook, giving you the advantage of using Microsoft's

popular browser while keeping access to Outlook's menus and tools.

Outlook includes many Exchange-specific components for creating applications. You can now design new forms, such as a

customized mail form, within Outlook, rather than using the external Exchange Forms Designer (though that's still an option). The built-in Outlook Forms Designer lets you create and place fields and controls on a grid. Similar to Notes, Exchange

SUITABILITY TO TASK		
Microsoft Exchange Server		
	Native client	Open client
Administration	Excellent	N/A
Messaging	Good	Good
Collaboration	Good	Good
Scheduling	Good	N/A
Applications development	Good	Fair
N/A—Not applicable. The product does not have this feature		

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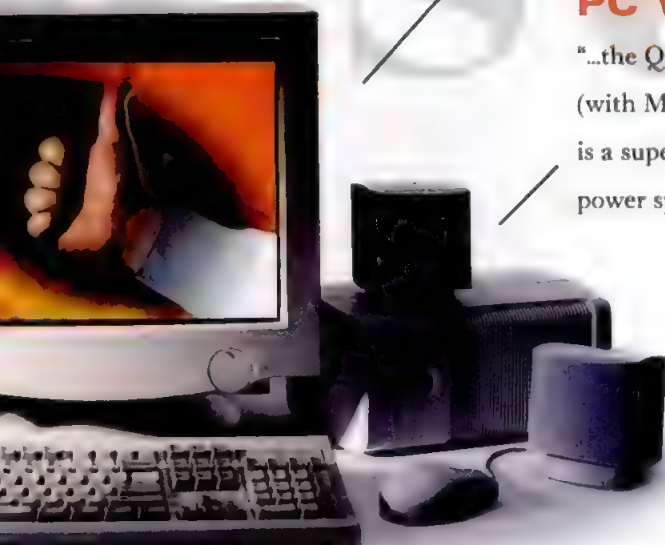
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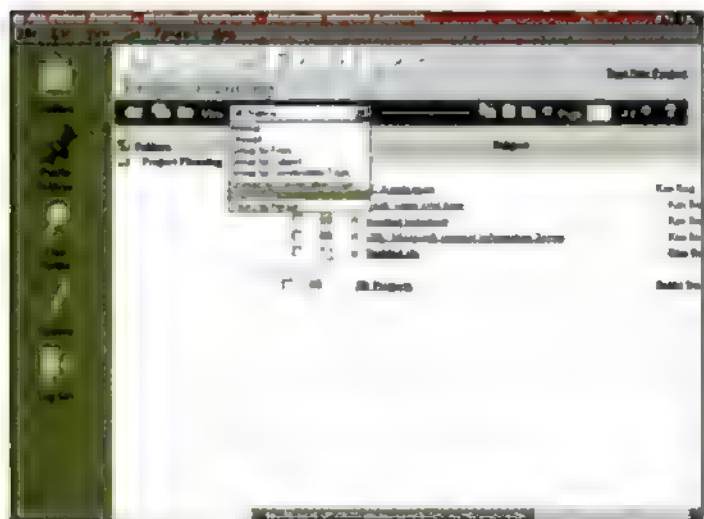
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Server lets you specify field types, such as numbers, date, or text, and even set rules to validate input. The intuitive designer is especially useful for creating customized mail and discussion applications, and it also lets you customize Outlook's calendar, contact, and other forms.

Outlook uses Microsoft's VBScript, a



Microsoft Exchange's Web client uses ActiveX controls to create HTML versions of Exchange messaging components, such as public folders.

streamlined version of Visual Basic, for automating forms and creating custom navigation tools. We found that VBScript makes it possible to produce some impressive workgroup applications. Like Notes APIs, MAPI gives developers working with tools such as Visual Basic relatively high-level access to the store, the directory, and other Exchange services.

THE INTERNET INFUSION

Microsoft takes big Internet strides with Exchange 5.0, allowing users to access its mail and public folders with Internet-standard clients. Users can send and receive mail with a POP3 client. Exchange can translate its proprietary text formatting into HTML, viewable by POP3 clients that can read HTML (including Netscape's POP3 client and the Microsoft Internet Mail and News client). Users with POP3 clients that don't read HTML, such as Eudora, can disable the feature in order to display plain text. The Exchange NNTP server works similarly with Exchange's public folders, which are NNTP-enabled by default, allowing a user with appropriate privileges to access Exchange discussions with any newsgroup reader.

Beyond simple mail and discussion folders, you can use Microsoft's Active Server Page (ASP) technology to create interactive Web applications for Exchange. ASPs are HTML pages with embedded

commands in Microsoft's JScript or any other scripting language. ASPs provide a basic architecture for creating dynamically generated Web applications. They have the ability to call a variety of other applications—such as the new ActiveX Messaging objects, which let developers reach into Exchange's services (including its message store and directory, to retrieve and render information in HTML pages).

Though ASP has promise, it lacks structure and functionality, especially when compared with Lotus Domino, which can render almost any type of database into HTML. Currently, the ActiveX Messaging objects cannot access some Exchange objects, such as calendar documents. For the most part, you're limited to discussions and standard messages. Also, customized forms created in products like Outlook have to be redesigned for HTML with a product like the forthcoming Microsoft Visual InterDev, a toolkit of Web design and management applications.—TP

Microsoft Exchange Server 5.0. Street price: standard edition, 100 users, \$6,143. Microsoft Corp., Redmond, WA; 800-426-9400, 206-882-8080; www.microsoft.com. Circle 443 on reader service card.

Netscape Communications Corp.

Netscape SuiteSpot 2.02

BETA If you are willing to sacrifice some functionality for simplicity and interoperability, Netscape SuiteSpot 2.02 and its Communicator client will be an attractive collaboration bundle. Built from the ground up using mostly Internet standards, SuiteSpot is a moving target that seems to have been locked perpetually in beta testing. Still, even without the features promised for SuiteSpot 3.0 this year, this is the most strongly Internet-based solution in our roundup; if that's your priority, it's the product to pick. But, if you're looking for a robust groupware platform with good Internet connectivity, consider Lotus Domino or Microsoft Exchange instead.

The SuiteSpot family consists of nine integrated servers, all based around Internet standards or near-standards including those for mail (SMTP, POP3, IMAP4, and MIME), Web documents (HTTP and HTML), discussions (NNTP), directory services (LDAP), and security (SSL and

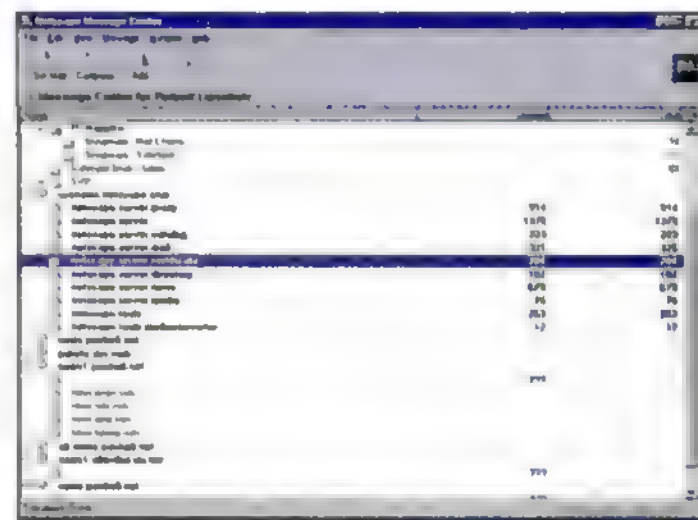
X.509). The SuiteSpot servers run on Microsoft Windows NT Server and Workstation, as well as various flavors of Unix, including Solaris and HP-UX. As you would expect, the only network protocol SuiteSpot supports is TCP/IP.

Integration across the servers occurs in three main areas—administration, security, and the applications development environment. Through a series of licensing agreements, source code purchases, and product acquisitions, along with its own product development, Netscape has put together a full intranet product suite. But we found varying levels of integration among the servers, which should improve with SuiteSpot 3.0 (see the sidebar "Future Groupware Directions").

All the SuiteSpot servers (except Calendar Server, which uses a command-line interface today) are managed through an HTML interface using forms, frames, and JavaScript. When you install a SuiteSpot server, an administration server that provides the administration interface is loaded. To encrypt a session, the administrator can use Secure Sockets Layer (SSL). Each physical server must be managed separately; SuiteSpot 3.0 will add some multiserver administration features, however.

EXCEEDING THE STANDARDS

The Internet client in Netscape's worldview is much more than a browser. In fact,



Netscape Communicator's Collabra client component unifies your e-mail and newsgroup folders into one interface.

the new Netscape Communicator Professional Edition client includes a Web browser, mail, news, calendaring, real-time conferencing, and IBM mainframe access abilities—making it look less like a simple Internet client and more like the GroupWise or Lotus Notes clients.

We looked at the publicly available pre-



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— PC WORLD, December, 1996 —

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release Version 2 for this story, and even though most of Communicator is based on standards, there are a few "proprietary" features. These include the use of HTML in the Messenger mail client (though HTML is a standard, using it to format e-mail messages is nonstandard), some extensions to the NNTP standard in the Collabra client, and a completely proprietary Calendar client. The good news is that the mail client has many improvements, like nested folders, IMAP4 support, and S/MIME for encrypting message content. Communicator also creates one in-box for all e-mail messages and news discussions.

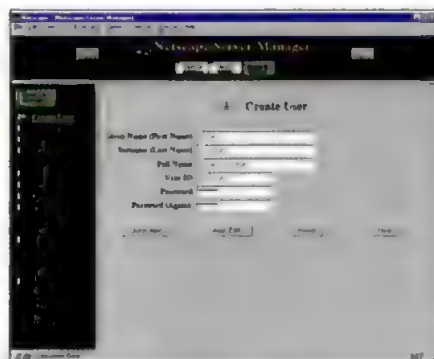
Netscape Mail Server (soon to be renamed Messaging Server in SuiteSpot 3.0) is an SMTP-, POP3-, and IMAP4-compliant e-mail server. The server can be accessed from any standard Internet client via either POP3 or IMAP4. Mail Server is one of the few commercial mail servers today that handles IMAP4—which offers remote-access features similar to those in traditional groupware products—but we couldn't get IMAP4 to work with the pre-release version of Communicator.

After e-mail, discussion groups best characterize groupware. On the Internet, the standard for discussion groups are Usenet newsgroups, which are replicated all over the world by NNTP news servers. Netscape Collabra Server is a fully compliant NNTP server with two proprietary extensions, built around the Collabra Share group discussion product, which Netscape purchased two years ago.

We reviewed the publicly available Collabra Server 3.0 Beta 2, the first of the SuiteSpot 3.0 servers. To make Collabra Server more attractive for corporate discussions, Netscape goes beyond typical NNTP servers in two important ways. First, the Collabra server and client allow users to create new discussion groups, whereas standard news servers and clients don't. Second, you can assign discussions names that are more descriptive than those using the standard dotted-name notation. You need the Collabra client and server to use these two features.

Another new addition to SuiteSpot is

Calendar Server 1.0. Netscape licensed the entire product and is in the process of integrating it with the rest of the product line. The version we saw ran only on Solaris; a Windows NT version is expected by June. Its difficult command-line administration interface bears no resemblance to what's found in other SuiteSpot



The browser-based Netscape Server Manager lets you manage users and SuiteSpot servers.

products. Netscape says the next version should rectify this.

The Calendar client is part of Communicator Pro, and the initial version we tested worked fine. This is the only piece of SuiteSpot that's entirely proprietary. But Netscape is working toward an Internet-standard calendaring protocol that eventually will be spun

into Calendar Server. Functionally, Calendar Server has features you would expect in a scheduling product, including off-line and on-line usage, people and resource scheduling, notifications, proxy users (for allowing someone else to manage your calendar), and personal tasks.

INTEGRATING THE PARTS

Enterprise Server 2.01, Netscape's high-end Web server platform, does not exactly fit into the mold of a groupware product. But if you want to build an application that integrates the features found in Mail, Collabra, and Calendar, your best approach is to have an HTML page sitting on Enterprise Server at the center of it all. A Web page is the perfect home base for a SuiteSpot application. With a click on a hyperlink in an HTML page, a user's Internet

client can launch the mail or news client. Enterprise Server also acts as Netscape's file store, so if your groupware needs include sharing files, you will want to include Enterprise Server. To set up and manage content on Enterprise Server, Netscape includes its LiveWire Pro. Compared with Domino's or Exchange's, however, the Netscape approach is unstructured and would require more development effort to reach the level of functionality that's built into traditional groupware.

Two other servers—the Directory and Certificate servers—will make SuiteSpot easier to manage and more secure. Directory Server stores user information and makes it accessible to end users and administrators through the Lightweight Directory Access Protocol (LDAP). The Communicator mail client can use LDAP to look up e-mail addresses, and SuiteSpot 3.0 servers will be able to use Directory Server to handle all user management tasks. You will be able to add users once to Directory Server and give access rights to SuiteSpot servers throughout the company. Certificate Server issues and manages digital X.509 certificates, required for security protocols like Secure Sockets Layer (SSL) and S/MIME.

Most development for SuiteSpot focuses around connecting Enterprise Server to relational databases. For development tools, Netscape partnered with three vendors to produce the separately sold SuiteTools bundle, which includes Netscape's LiveWire, a content management tool; Symantec Visual Café, a Java development environment; NetDynamics, a Java database connectivity tool; and NetObjects' Fusion, an HTML authoring and site management product. SuiteSpot 3.0 will add Internet Foundation Classes (IFCs) to each server, so developers can write Java and JavaScript applications and scripts to access functions within each server. But unlike Domino and Exchange, which provide integrated environments, SuiteSpot requires developers to write separate programs for each of its servers.—Robert P. Lipschutz □

Netscape SuiteSpot 2.02. List price: unlimited server license, \$4,995; Netscape Communicator Professional Edition, \$79.95 per user. Netscape Communications Corp., Mountain View, CA; 415-937-2555; www.netscape.com. Circle 444 on reader service card.

SUITABILITY TO TASK		
Netscape SuiteSpot		
	Native client	Open client
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Messaging	Good	Good
Collaboration	Fair	Good
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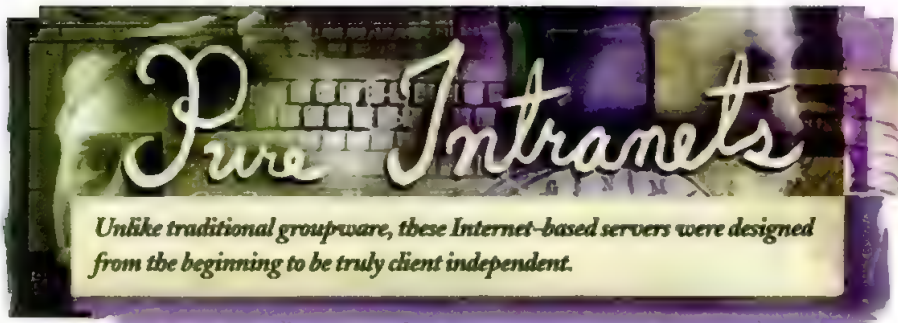
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By Todd Spangler

Traditional groupware and e-mail systems rely largely on proprietary clients for functionality. Even Netscape, the Mao of the Internet-standards revolution, now has stuffed its Communicator client and its SuiteSpot servers with rich features unavailable in standard Internet software. In this section, we review a sampling of popular collaboration products designed for use with baseline Internet software.

Intranet server software should work seamlessly with any standard Web browser, e-mail client, or newsgroup reader. The enticing mix-and-match promise of intranets is that you aren't dependent on one vendor or operating system, so if you find you don't like a particular client or server, you can substitute another without breaking your infrastructure. Of course, much of the software here doesn't match the extensibility, integration, and usability of groupware packages. But if an Internet-standards environment is suitable for your collaboration needs, you'll want to consider one of these solutions.

WEB GROUPWARE

Unlike the full-service groupware reviewed in the main roundup, Web groupware products are not supposed to be all-in-one solutions that provide a corporate messaging infrastructure. Web groupware—which lets users interact instead of simply browsing Web content—is ideal for organizations that have an established e-mail package and are looking to fill the collaborative gaps.

Here, we review four such products: AltaVista Forum 2.0, Thuridion's CREW, WebFlow Corp.'s SamePage 2.0, and Radnet's WebShare 1.2. These systems, which require only a standard Web browser for client access, don't include

e-mail servers per se but do provide access to POP3 and SMTP mail systems. CREW also provides a Web-based e-mail option that can be linked with external mail servers.

All the systems provide useful collaborative tools, but they have different approaches to groupware and vary in complexity. Of the products we review here, AltaVista Forum 2.0 provides the best out-of-box solution. Keep in mind that none of the Web groupware products permit disconnected use, though WebShare's next release will allow off-line replication.

MAIL AND NEWS SERVERS

E-mail now is—and probably will continue to be—the most common means of electronic communication. The Internet e-mail world is in transition from the widely used but fairly basic Post Office Protocol (POP3) to the more sophisticated Internet Mail Access Protocol (IMAP4), which includes features such as adding shared folders and remote access.

We looked at five mail servers for Windows NT Server, each of which supports POP3 and SMTP for sending and receiving messages to and from other mail servers. Of the servers we reviewed, only AltaVista Mail 2.0 currently supports IMAP4, though the other vendors say they eventually will support it. Netscape's Mail Server, reviewed in the first section, and Sun's Solstice Internet Mail for Solaris are other IMAP4 servers. An Internet mail server is a logical choice if you need an easy, affordable way to provide internal e-mail and to send and receive mail seamlessly via the Internet.

News servers (more appropriately called *discussion servers*) are a harder sell. The functionality of these servers and clients is far behind that of Lotus Domino and other solutions. Though news servers

can be used to host internal company discussions, most of them host Usenet newsgroup feeds. We looked at two Windows NT news servers using standard NNTP: MetaInfo's NewsChannel 1.0 and Frontier Technologies' NewsServer, part of Intranet Genie 1.3.

Web Groupware

AltaVista Internet Software

AltaVista Forum

Part of AltaVista's line of Internet-based servers, AltaVista Forum 2.0 (\$495 list for 25 users) provides the most complete out-of-the-box solution among the Web groupware products we reviewed. It gives workgroups an easy-to-use collaboration solution, offering group discussion, document sharing, and scheduling through any standard Web browser. Other AltaVista products include an IMAP4-compliant mail server (also reviewed in this section), a firewall, a tunneling server for secure access to a corporate network via the Internet, a search engine, and an LDAP-compliant directory server.

We set up AltaVista Forum quickly and easily on an Intel-based Windows NT Server. It's also available for Windows NT on Alpha, Solaris, and Unix. Like the other Web groupware products we reviewed, AltaVista Forum requires a Web server and works with an assortment of popular ones. We used Microsoft Internet Information Server.

When you set up AltaVista, you designate someone as the AltaVista Forum Administrator, who can either add users or optionally allow them to join forums on their own. Users are placed in groups by the Administrator, who then grants them access rights. The first page that an AltaVista user sees is the Summit page, a table of contents for all the resources available. The Summit page also allows users to register and access the help system.

AltaVista Forum provides five different work areas: Discussion, Document, Newspaper, Calendar, and Conference. The Discussion forum allows anyone in a group to create, read, and reply to topics of interest. Document forums let a group's members organize folders for any

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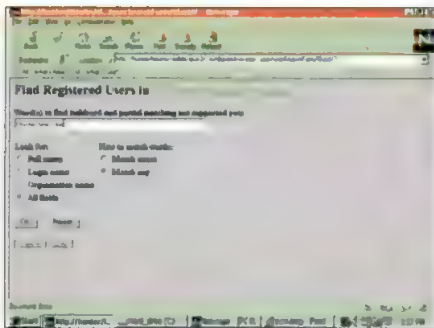
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AltaVista Forum includes an integrated version of the company's well-known search engine.

kind of document. The Newspaper forum allows users to filter information from a variety of Internet sources; and the Calendar forum provides basic scheduling features. The Conference area offers an Internet Relay Chat interface for real-time discussions.

In the Discussion forum, a user sees a

list of current topics, along with the number of replies to each. Within a message, you can add hyperlinks to documents in the system or URLs to documents on the Internet. Topics can be deleted only by the Administrator or by the user who created the topic.

Compared with traditional groupware, navigating AltaVista Forum's document folders via a Web browser is sometimes disorienting, as with all the Web groupware we looked at. Version 3.0 of AltaVista Forum, due out by midyear, will support hierarchical folders, multiple views, and frames for easier navigation.—*Padraic Boyle*

AltaVista Forum 2.0. List price: \$495 for 25 users; \$3,995 for unlimited users. AltaVista Internet Software, Littleton, MA, 800-336-7890, 508-486-2308; altavista.software.digital.com. *Circle 458 on reader service card.*

Thuridion CREW

Thuridion's CREW collaboration package lets you create a virtual office environment, providing e-mail, scheduling, and document sharing entirely through a Web browser. Like AltaVista Forum, CREW (\$2,495 list for 25 users) is easy to install and to configure, and we had the system up and running right out of the box. However, we found CREW's discussion interface to be kludgy, and we think most users would use a separate mail client instead of Web-based e-mail. AltaVista's approach to mail using a separate e-mail client is preferable.

CREW consists of a suite of applications accessed through the main Office interface after logging on with your user name and password. The CREW Card-File is an address book for storing your personal CREW account information.

Real-Time Internet Collaboration

By Jan Ozer

Where groupware tends to focus on sharing information and building consensus over time, real-time collaboration software lets a group quickly finalize a memo or brainstorm new ideas. Here we look at three such products: Microsoft NetMeeting, Netscape Conference, and VocalTec's Internet Conference Professional. Of these, VocalTec's ICP offers the most comprehensive and integrated solution, but at \$149 list it's more expensive than either Conference (part of Netscape Communicator, \$59 list) or NetMeeting (free to download).

These products use whiteboards, application sharing, chat, and file transfer to facilitate collaboration over the Internet. While the tools also have audioconferencing capabilities to act as "Internet telephones," the telephone on your desk does a better job. The real value for business users is in the collaborative data functions these products provide.

The first critical distinction regards whom you can work with. Netscape Conference can handle only two users,

while NetMeeting can manage up to 32 and ICP as many as 255 (according to VocalTec). Operating-system support also varies: NetMeeting is available only for Microsoft Windows 95 and Windows NT, whereas ICP is available for all Windows versions, and Conference runs on Mac and Unix in addition to Windows. Here's how the products' specific features compare.

- **Whiteboard.** Like their namesake fiberboard counterparts, whiteboard software programs let users draw, type, and annotate on their electronic surfaces, which are generally large, white rectangles surrounded by drawing tools. You can paste in images or screens from other programs or start with a tabula rasa. Each of the three programs offer similar whiteboard functions, with a range of drawing implements and other tools such as remote pointers and screen capture.
- **Application sharing.** Only ICP and NetMeeting offer application sharing, which lets multiple users edit the same document. ICP lets users view the shared document from inside their whiteboard, with complete access to all annotation tools. By

contrast, NetMeeting offers no integration between the two functions. On the other hand, NetMeeting uses a GDI-based protocol called T.Share that lets all conferees view and edit the document, even if the source application isn't installed on their systems. ICP uses OLE, which lets users who have the application installed edit the document, while others can only view it.

- **Other services.** Collaborative file transfer comes in handy when distributing files before, during, or after the conference. Text-based chat provides a primitive form of communication when either telephone or Internet phone capabilities are unavailable. The file-transfer and chat capabilities of the three programs are roughly equivalent.

One feature unique to ICP is its ability to save an entire conference session. While NetMeeting and Conference can store the contents of the whiteboard or chat sessions separately, ICP stores both in a combined file with a summary containing the conference subject, time and date, duration, and participants.

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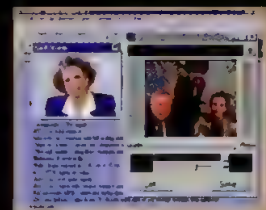
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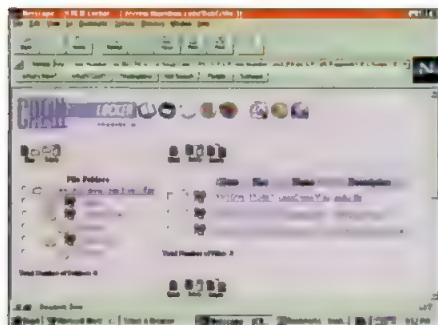
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The CREW Locker lets you share files with anyone via a Web browser.

Internet mail. To host a group discussion, you share one of your e-mail folders—not our idea of a robust discussion.

Users in CREW belong to one or more groups, and the system's e-mail and scheduling functions are integrated with CREW groups. An interesting feature of CREW lets users grant guest access to people who are not CREW members, even users on the Internet. For example, you can assign a user name and password to just your Calendar—without any intervention required by the system administrator. This can introduce a security problem: CREW does not provide security beyond an unencrypted password.

Currently, CREW is available only for Windows NT Server, but Thuridion plans to make it available for Solaris later this year. Although CREW uses a CGI interface and should interoperate with any CGI-compliant Web server, CREW recommends Netscape FastTrack 2.0, which provides file-uploading capabilities.—**PB CREW**. List price: \$2,495 for 25 users; \$49 for each additional user. Thuridion, Scotts Valley, CA; 408-439-9800; www.thuridion.com. Circle 459 on reader service card.

WebFlow Corp. SamePage

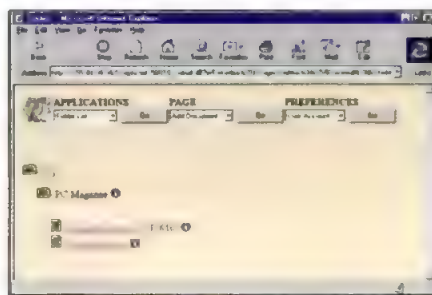
SamePage 2.0 is not simply a discussion tool. It's a sophisticated project-management and collaboration system that pro-

vides a true Web workflow environment. At prices starting at \$3,500 (list) for ten users, this WebFlow product offers groups serious task management and workflow features.

We found SamePage easy to install and administer. Through a browser interface, you add users and groups and perform other management tasks. Default templates are provided to get you collaborating in no time at all. And the templates are easy to edit; you can use any HTML editor to customize SamePage to your company's needs. In addition to POP3 mail and SMTP, SamePage supports Lotus cc:Mail and Microsoft Mail.

The two main modules of SamePage are WorkSpace and TakeAction. In WorkSpace, members of a group collaborate on a project. SamePage takes a different approach to collaboration than other groupware packages: Instead of handling separate messages, SamePage creates a single page—the WorkSpace—accessible to multiple users. Users access and update the WorkSpace, adding their comments. Unfortunately, a WorkSpace can include only text, HTML, and images. Documents are stored in what are known as chapters, which contain summaries of each discussion section along with a link to the original discussion. This provides a valuable record of the decision process.

The TakeAction module manages the workflow process. When individuals or



The SamePage interface has helpful navigational menus at the top of each page.

groups are assigned tasks from the discussion in the WorkSpace, TakeAction sends notification via e-mail about assigned tasks or changes in a task's status. Users can accept, deny, or pass tasks on to another member of the group. A person designated as the task manager can keep track of who's working on which tasks.—**PB**

SamePage 2.0. List price: \$3,500 for 10 users (\$20,000 for 100 users). WebFlow Corp., Santa Clara, CA; 408-235-1400; www.webflow.com. Circle 460 on reader service card.

Radnet Inc. WebShare

If you're looking for an open-platform tool to design Web groupware applications for your company or for a customer, you will want to consider Radnet's WebShare 1.2. This highly customizable set of Web tools allows a professional developer to provide Web collaboration for almost any need. Unlike Lotus Domino, which provides a similar architecture for building custom Web applications, WebShare stores its information in any ODBC-compliant database instead of a proprietary format.

WebShare is available in two versions: WebShare Server (\$2,195 list) and WebShare Designer (\$995 list). The WebShare Server, the component running the collaborative environment, is currently available only for Windows NT Server, but Radnet plans versions for Solaris and other Unix platforms. Designer, which includes a runtime version of WebShare Server and a copy of the Spyglass Web server, is used to create and modify WebShare templates.

WebShare works with any Web server via CGI, the Microsoft-supported Internet Server API, or the Netscape Server API. A relational database is the driving engine behind the product. WebShare Server ships with a Sybase SQL Anywhere database. In addition, Radnet ships two modified editions of WebShare; these versions are fine-tuned to work with Microsoft BackOffice and Netscape SuiteSpot.

Although installing WebShare was not difficult, configuring it was. Unlike AltaVista or SamePage, which come ready-to-run out of the box, WebShare is intended for an experienced Web developer. WebShare does provide eight starter applications—Discussion, Moderated Discussion, Newsletter, Contact Library, Employee Directory, Event Calendar, Problem-tracking Database, and Resource Scheduler—but these are just examples of what can be accomplished with WebShare's developer tools.

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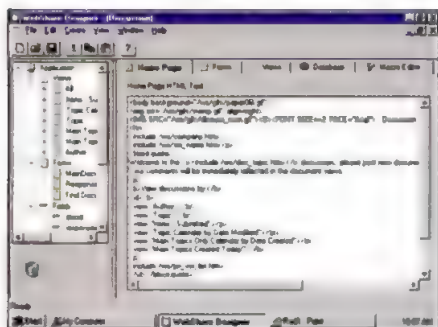
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In the next revision of WebShare, Version 2.0 (due out by the time you read this), Radnet says that WebShare Designer will offer enhanced development, including a WYSIWYG interface with



WebShare Designer gives developers the ingredients to create Web-based applications.

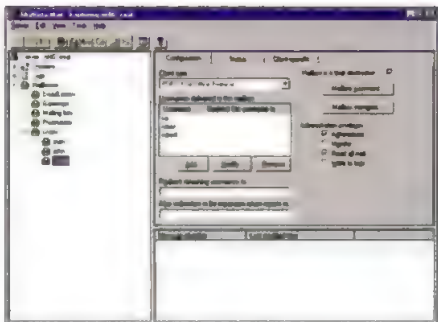
drag-and-drop interface design capabilities. For road warriors, Version 2.0 will include bidirectional replication software for Windows 95 and Windows NT for mobile applications.—PB

WebShare 1.2. List price: WebShare Server, \$2,195 per server; WebShare Designer, \$995. Radnet Inc., Cambridge, MA; 888-723-6381, 617-577-9422; www.radnet.com. Circle 461 on reader service card.

Mail & News Servers

AltaVista Internet Software AltaVista Mail

AltaVista Mail has a good assortment of management features accessible through an approachable Windows application or an HTML interface. Other than Netscape Mail Server, AltaVista Mail 2.0 (\$495 list) was the only mail server we reviewed that supports IMAP4, especially useful for mobile mail users. The AltaVista product line includes several other Internet-based



AltaVista Mail's Windows management interface is easier to use than its HTML counterpart.

servers such as AltaVista Forum for group discussions (also reviewed in this section).

AltaVista Mail has one of the best management interfaces we've seen. Administrators can set up users with a wizard in the Microsoft Windows application or with a series of HTML forms. We much preferred the Windows interface (for Windows 95 and Windows NT) to the HTML forms, but we liked having the flexibility to administer from any Web browser. In addition, users can access the Web interface to change their passwords or forward their mail to different mail accounts.

As you would expect, AltaVista Mail runs on Windows NT Server for Digital's Alpha as well as the Intel platform (but unlike other AltaVista servers, it's not available for Unix). The product includes complete logging options for IMAP4, POP3, and SMTP operations, giving administrators the right level of depth for solving problems. A simple test routine will tell you if all the server components are working. AltaVista Mail does include a mailing-list feature, but there is no way to set a storage limit per user for POP3 mail.—Robert P. Lipschutz

AltaVista Mail 2.0. List price: \$495 per server. AltaVista Internet Software, Littleton, MA; 800-336-7890, 508-486-2308; altavista.software.digital.com. Circle 462 on reader service card.

Ipswitch Inc.

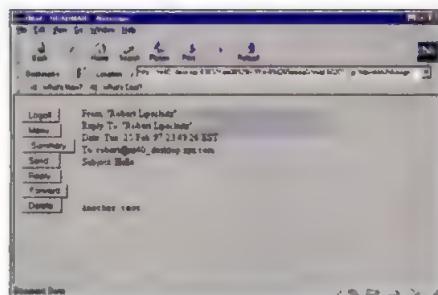
IMail Server for Windows NT

Ipswitch is an aged veteran, relatively speaking, in the Internet-based mail game on Windows NT: Its IMail Server for Windows NT 3.04 (\$495 list) has been around since 1995. With allied products, IMail Server provides an assortment of client and server products having a smattering of Web functionality for administration and for accessing e-mail. It runs on Windows NT on both Alpha and Intel platforms. IMail Server combines POP3 and SMTP mail with a number of utility services including Finger, List, and Whois, along with a variety of administrative services. IMAP4 is promised for the next version.

IMail Server provides two ways to administer the server. An HTML interface lets you add users, check logs, and make configuration changes. End users can

access the configuration Web page, where they can see a subset of the information that lets them change their passwords, add forwarding addresses, and set up automated response e-mails (such as "I'm-on-vacation" messages). Administrators have the option to use a functionally complete—though slightly more difficult to use—Windows application from the Windows NT console.

Ipswitch includes the IMail Client for Windows, a standard POP3 e-mail client with a nice address book and a rules-based filtering feature. The Web Messag-



IMail's Web Messaging option provides an HTML interface to a POP3 mailbox.

ing option allows a Web client to access a mailbox, which seems like a great idea at first, but it suffers from limitations such as the lack of an address book and no message-sorting features. The Web client will be most useful for those without an e-mail client—or perhaps those without the knowledge to use one.—RPL

IMail Server for Windows NT 3.04. List price: \$495 per server; Web Messaging option, \$195. Ipswitch Inc., Lexington, MA; 617-676-5700; www.ipswitch.com. Circle 463 on reader service card.

Frontier Technologies Corp.

Intranet Genie

Intranet Genie 1.3 wins our award for the most software in one small box. Aimed at small to medium-size companies that want an all-in-one package, Intranet Genie contains some 20 different components including DNS Server, MailServer, Network Timer Server, NewsServer, and SuperWeb Server. The client components include Frontier Technologies' own browser as well as a CyberSearch utility, FTP, Microsoft Internet Explorer, newsgroup reader, POP3 e-mail client, and uuencode utility. As a result, it's more expensive



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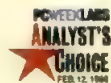
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*Based on video, audio and image processing elements of the Intel Media Benchmark.
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(\$2,495 list) than the other products reviewed here.

You can't go wrong installing and configuring Intranet Genie—it won't let you. Once up and running, each of the many servers is configured through its own tab interface.

The options for MailServer do not include the more advanced features offered by AltaVista Mail and Ipswitch, such as user-managed passwords or an HTML interface. A unique feature of MailServer, though, is the ability to assign expiration dates to e-mail accounts for temporary or contract workers. Users can also be given multiple e-mail addresses, and numerous log-on options are provided. Currently, MailServer does not support IMAP4.

The NewsServer has all the basic functions you'd expect. Access control can only be based on TCP/IP address or domain, not user name or passwords; this may not be enough for sensitive internal discussions. NewsServer can send an e-mail message to the news administrator before taking action on control messages received from other servers intended to create or delete newsgroups.—RPL

Intranet Genie 1.3. List price: \$2,495; \$49 per client. Frontier Technologies Corp., Mequon, WI; 800-929-3054; www.frontiertech.com. *Circle 464 on reader service card.*

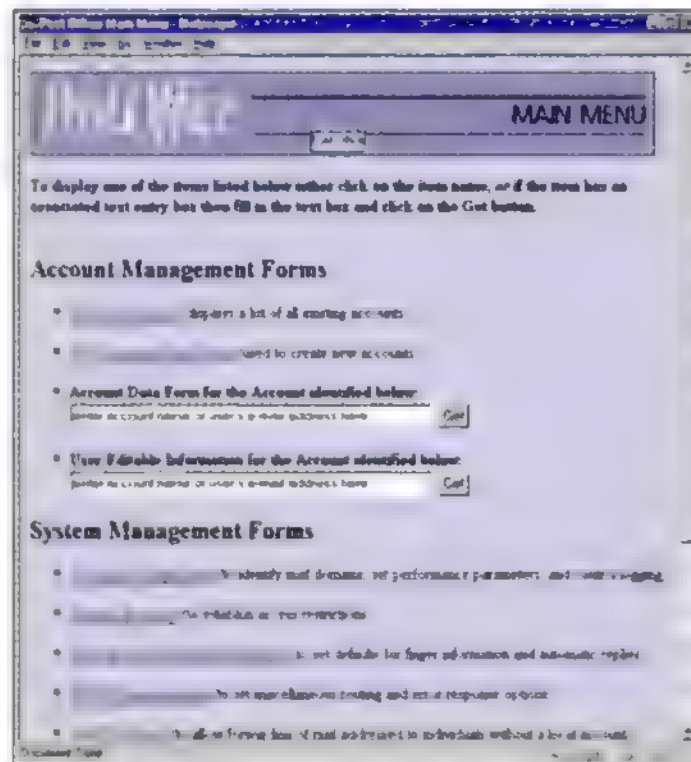
Software.com Inc. **Post.Office**

Post.Office 2.0, Software.com's full-featured mail server with intuitive HTML-based administration, comes in multiple versions for Windows NT Server on Alpha, Intel, and MIPS, as well as for various Unix platforms. The only major option Post.Office doesn't yet support is IMAP4, an omission to be rectified in a release later this year.

Every administrative task can be accessed through HTML pages. As with most server products, you'll probably make many changes when you first install and configure the mail server, and then fewer as time goes on. At installation, you'll want to add user accounts, POP3 storage limits, and default error messages sent to users when an e-mail account doesn't exist. Typical daily tasks include adding new users, adding for-

warding addresses, and checking for queued mail.

Post.Office sends new users a message with their e-mail account name and directions on how to make changes. Users can change their passwords and compose auto-reply messages by using an HTML form or by sending an e-mail request for a form, filling it out, and returning it to the



Post.Office allows access to every administrative task through its HTML interface.

server—all without involving the network administrator.

Novice mail administrators, or those who want to know more about POP3 and SMTP, will appreciate the helpful online software manual and the installation walkthrough available on Software.com's Web site. Netscape licensed its Mail Server code initially from Software.com, so if you're familiar with the Netscape Mail Server, you'll have a pretty good head start understanding Post.Office.—RPL

Post.Office 2.0. List price: Free for up to 10 users; \$149 for up to 20 users; \$995 for an additional 500 users. Software.com Inc., Santa Barbara, CA; 805-882-2470; www.software.com. *Circle 465 on reader service card.*

MetaInfo Inc. **Sendmail with POP3 for Windows NT, NewsChannel**

We caught MetaInfo in the middle of adding a pretty face to its aptly named Sendmail with POP3 for Windows NT, Version 1.1. As far as we know, it is the only commercial Microsoft Windows NT port (available for both Alpha and Intel) of the sendmail daemon that's used on

many Unix platforms. As such, Sendmail has a bare-bones interface combined with a text-based configuration.

Currently, Sendmail supports POP3 and SMTP, but IMAP4 will have to wait for MetaInfo's next-generation product, Enchilada—due out later this year. Sendmail is as configurable as its Unix cousins but also has the complicated Unix command-line configuration. Version 2.0, due out when you read this, will add an HTML front end. Two stark control panels make up the management interface. Everything else is configured by making changes to the SENDMAIL.CF configuration file. This version doesn't allow users to set up POP3 storage limits, though it does allow administrators to set maximum mail-file limits.

Sendmail has some advantages, however: It provides easy programmatic interfaces to the entire e-mail header and content. For example, it would be easier to use Sendmail than other products if you want to write an application that sorts out all of your e-mail by time sent and then calculates all the messages you've received in a given period.

MetaInfo's NewsChannel 1.0 is a full-functioned news server that comes with a straightforward interface. It uses a Windows Explorer-like metaphor for displaying newsgroups, easing the process of picking appropriate newsgroups from other servers. A similar interface is used for configuring the server.

After a quick installation, wizards walk you through setting up access control based on user name, TCP/IP address, and domain name. NewsChannel has the most flexible access control of the products evaluated here, and it includes groups to make administration less cumbersome.

We also liked its flexibility: You can choose the amount of log information gathered, including incoming client and server connections and outgoing feeds. You can set flexible expiration rules for each newsgroup or for an entire hierarchy of newsgroups based on the message's age or the newsgroup's size.—RPL □

Sendmail with POP3 for Windows NT, Version 1.1. List price: \$495 per server. **NewsChannel 1.0.** List price: \$795 per server. MetaInfo Inc., Seattle, WA; 206-674-3700; www.metainfo.com. *Circle 466 on reader service card.*

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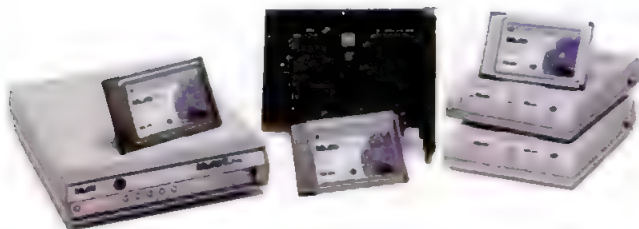
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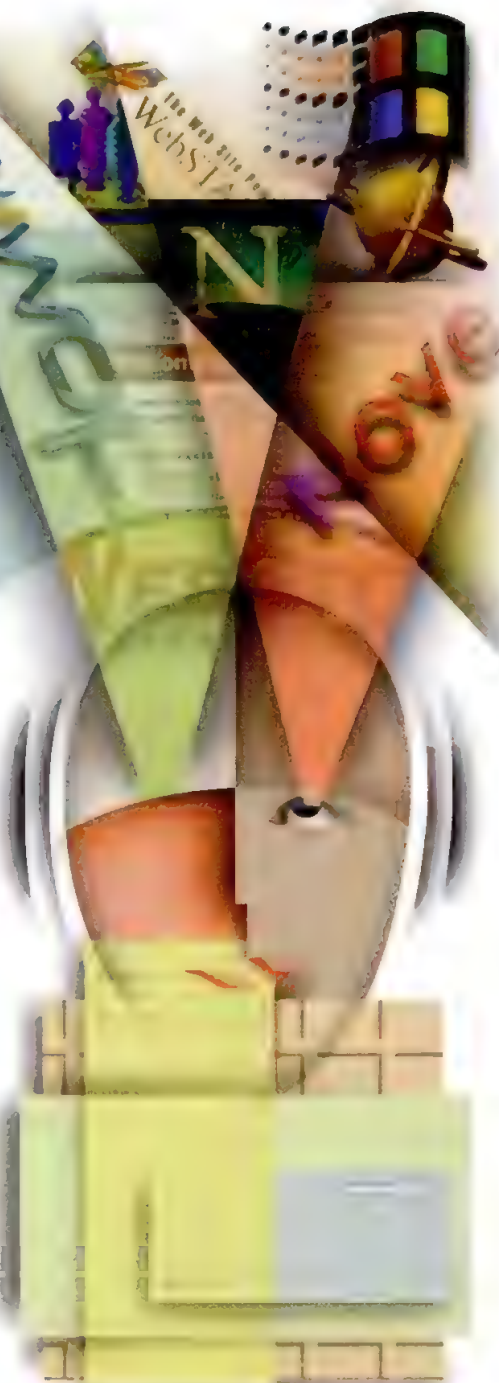
You're no longer limited to running your Web site from a Unix box. Windows NT running under Intel hardware provides a viable alternative.

By Todd E. Columb

With corporate intranets rising in popularity and companies scrambling for commercial Web presence, IT departments are embracing Web servers as logical extensions of their existing LAN and WAN infrastructures. The benefits of an open, platform-independent means of disseminating information, supporting customers, and extending the reach of legacy systems are too great for corporate America to pass up.

In the not-too-distant past, all Web servers were back-office enigmas accessible only to expert Unix Webmasters. Today, Web servers are available for all major platforms, including various types of Unix, Windows NT, Novell's IntranetWare (an included component of NetWare 4.x), OS/2 Warp, Mac OS, and even Windows 95. Unix still dominates, but Windows NT and other platforms are catching up. Web servers have truly hit the mainstream.

Since our last look at Web servers (*PC Magazine*, September 10, 1996), major strides have been made in ease of use and integration. For the latest crop of Web servers, much of the setup and configuration can be done in-house—something most IT departments could only dream about a year ago. Packages like Novell Web Server and Microsoft Internet Information Server are part of a growing trend to integrate Web servers with the underlying OS, letting you share user databases and configuration settings. (For the groupware portion of your corporate



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communications strategy, see our product roundup "Multiple Personalities.")

CHOOSE YOUR WEAPONS

As Web servers increasingly become feature sets bundled with an OS, your choice of a Web server will ultimately depend on which platform you've selected and where your in-house expertise lies. This expertise might lie in knowledge of the OS or in the programming to extend your server's capabilities. The universality of TCP/IP

networking means you can mix other server types in your intranet—such as a Unix server in a Windows NT network—but this may not be the best use of your resources.

In this roundup, we consider today's most popular Web servers running under several popular operating systems and hardware platforms. The platform and OS you choose for your Web server should be ones with which you are already familiar.

We ran ten Web servers from nine

vendors under eight operating systems on five hardware platforms. On Intel-based hardware and under Windows NT 4.0, we evaluated Lotus Domino, Luckman's Web Commander, Microsoft Internet Information Server, Netscape Enterprise, Netscape FastTrack Server, and O'Reilly & Associates' WebSite Professional. We considered Enterprise and FastTrack under Solaris 2.5.1 on a Sun Netra, under Irix on an SGI WebForce Origin200, and under Digital Unix on a Digital Alpha.

Building a Web Site

LOTUS DOMINO



1. Create a new Notes database after planning out the Web site you want to build



2. Notes' graphical user interface lets you modify the design according to how you would like it to appear on the Web



3. Use Domino's native facilities if your site is going to access external data.



4. Create dynamic links to Notes databases to update your pages as the databases change.



5. Implement security by modifying Notes' Access Control Lists.

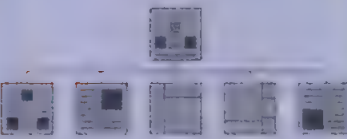


6. Create dynamic views that change content or presentation for different users. You can base views on such variables as browser or user type, or let users request views.

NETSCAPE ENTERPRISE SERVER



1. Code in HTML after conceptualizing your site



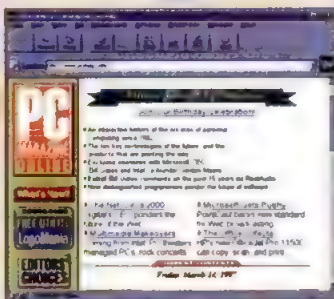
2. Use LiveWire's Site Management templates to design the look and feel of your site



3. Add in code to spice up the image of your site or to provide application functionality



4. Add connectivity and create security using native features, third-party certificates, or other forms of security



MICROSOFT IIS



1. Map in HTML after conceptualizing your Active Server Pages-based site



2. Create ActiveX components or use existing ones to access your dynamic data



3. Use in-line scripting (JScript, VBScript) to invoke ActiveX components, thereby creating dynamic content or Web applications



activex

4. Use Visual InterDev or other HTML tools to create ASP applications



5. Copy your finished pages to the executable directory on the server—no compiling needed.

Editors' Choice

- For Windows NT: Microsoft Internet Information Server 3.0
- For cross-platform or Unix: Netscape Enterprise Server 2.01
- For NetWare 4.x: Novell Web Server 3.0

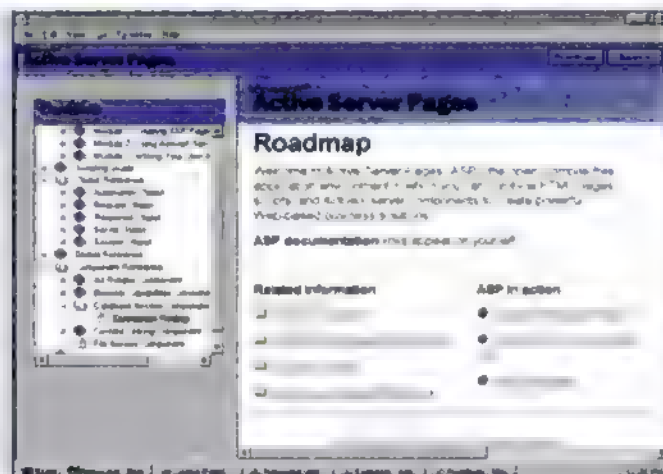


Choosing the right Web server largely depends on where your in-house expertise rests. For users of Microsoft Windows NT and Intel hardware, our Editors' Choice

is Microsoft Internet Information Server (IIS) 3.0. For Unix shops—or for those operating in cross-platform environments—our Editors' Choice is Netscape Enterprise Server 2.01, the Web server with the most flexibility, features, and performance. For those running their LANs on NetWare, our Editors' Choice is Novell Web Server (NWS) 3.0, a logical and powerful choice to extend your capabilities to the Web.

IIS benefits tremendously from its integration with the operating system. You get tighter security, better reporting, and the ability to use your Windows NT user database for Web server access control. You get the richest suite of bundled tools, including FrontPage 97 for Web page creation and management, Crystal Reports for reporting,

and Index Server and Net Show for search capabilities and multimedia, respectively. You have great opportunities to extend your Web site with IIS, thanks to its server-side scripting functionality with Active Server Pages, ActiveX, JScript, and VBScript. IIS also offers strong performance, as we discov-



Microsoft IIS Active Server Pages.

We tested the public-domain version of Apache under RedHat Linux on a Compaq with Intel processors. We also looked at IBM Internet Connection Secure Server on Intel hardware under OS/2 Warp, Novell Web Server under IntranetWare 4.11, and StarNine's WebStar on a Power-Mac under Mac OS.

KNOWING YOUR STUFF

A good working knowledge of TCP/IP and basic networking principles can facilitate a hassle-free Web server installation. We installed each of the products in minutes, with the exception of Apache, which requires advanced knowledge of Unix to configure the HTTPd (HTTP daemon) server. In fact, you actually edit the source code and recompile the Web server's executables when changing the configuration.

We looked for comprehensive documentation and, for the most part, were not disappointed. Several products include online HTML-based documentation—a definite plus. Microsoft includes excellent

HTML documentation but no hard copy. As always, O'Reilly's print manual and HTML help were impeccable. Apache provides almost no documentation other than some README files.

Once your server is running, you'll want to fine-tune it. Some packages allow more advanced customization than others. Having access to the source code in Apache provides the ultimate in customization. More common is the ability to create custom error messages and default Web page headers and footers, something Enterprise, ICSS, and Web Commander could do.

THE MORE THINGS CHANGE . . .

The dynamic nature of Web content means Web servers need a fair amount of hands-on attention. Thanks to Web

ered during testing.

Enterprise runs on any number of operating systems and hardware platforms, so it's an ideal choice for those needing to deploy a Web site across a network with varying hardware. Enterprise features superior site management tools and serves as a very strong development platform, supporting JavaScript and NSAPI for server-side applications to extend your Web site beyond static HTML pages. It's also highly configurable and offers excellent database connectivity (as does IIS). Enterprise performed remarkably well during testing, particularly when running under Digital Unix and Windows NT.

Because it's bundled with its operating system, NWS offers many of the same advantages as IIS does in being bundled with Windows NT. NWS integrates fully with NetWare Directory Services, giving you complete control over both NWS and NDS management from within a browser. NWS supports URL redirection and forwarding but also lets you store Web pages on any NetWare server on your network, regardless of whether it is configured as a Web server. Being able to distribute your intranet resources across several servers is a big plus for large sites, ensuring that you don't overtax your main intranet server.

browsers, you don't always have to be in front of your server to administer it.

Most products offer remote administration via a Web browser, though with varying implementations. Netscape provides browser-based administration only, and we found the interface clumsy on anything but a large, high-resolution monitor. O'Reilly's WebSite supports remote administration only through the installation of a customized version of the Web server on another machine. IIS provides both a Windows utility and a browser-based administrator. Mac-based WebStar's remote administration, with its excellent use of color and space, is the best browser-based implementation we've seen yet.

As Web servers become more common, Web site management tools must

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become more intuitive. Site management tools are sophisticated enough to check and repair links and provide graphical maps of Web sites. Content management tools are more visually oriented, letting you create pages with drag-and-drop rather than arcane HTML tags.

Some vendors, such as Microsoft and Netscape, bundle their own tools, while others, such as Luckman, add popular third-party tools. Still others, like Apache and IBM, stick to Web server basics and require you to purchase your favorite add-on Web tools. Enterprise Server's LiveWire add-on includes a site management module and an application manager with one of the slickest Java debugger tools we've seen. We found Microsoft FrontPage 97, included with IIS, to be the most powerful Web-page editor of the bunch.

BAR THE DOOR

As more and more Web sites are used to share sensitive information, tight security and encryption become necessities. The most common form of security supported by Web servers is basic authentication, in

which users provide a user ID and password. All the servers we reviewed supported such basic authentication. Some servers go a step further and allow access restriction by IP address or host name.

You can use encryption to protect against wire sniffers. Web servers use Secure Sockets Layer (SSL) to support encryption. All commercial servers support SSL 2.0, but some, such as Netscape's servers and IIS, implement SSL 3.0. SSL 3.0 supports more key-exchange and encryption algorithms (such as Fortezza) and performance optimizations than Version 2.0. SSL creates a secure, encrypted channel between the server and browser by using certificate authentication. Using SSL, a certificate authority, such as VeriSign, provides server certificates for a fee.

All the products handle security admirably except for Apache, whose public-domain version does not support SSL. (Secure versions of Apache are available from Stronghold.) Lotus Domino has the strongest security, providing access control not only through Domino but also through Lotus Notes' field-level access

and the Windows NT Server user database. Web servers that share the operating system's user database, such as IIS and NWS, not only provide an extra level of security but simplify management as well. For secure intranet sites, Domino, ICSS, and NWS can generate their own certificates, saving you the time and expense of requesting public ones.

A BIGGER PICTURE

Web servers are not limited to transferring static HTML pages. Java and its supporting scripting languages provide an ideal Web development platform. All the products we looked at, except for Apache and ICSS, support server-side Java. Several of the Web servers include custom APIs, and a few support the more common Netscape Server API (NSAPI). NWS provides a unique variant of CGI called LCGI for developing custom NetWare Loadable Modules.

The most common form of Web programming uses a scripting language; these servers offer many options, such as Domino's LotusScript, Netscape's JavaScript,

WEB SERVERS

How to Read the Suitability to Task Boxes

Documentation We look for clear, easy-to-follow manuals. Thoroughness ensures a high rating for power. Products with documentation both in HTML and in printed, bound formats receive high ratings.

Installation and configuration The setup program should run correctly, and we look for products with thorough installation scripts or wizards. We assume users will have a reasonable knowledge of TCP/IP configuration and Web servers but still expect an intuitive setup routine. Users should be able to run a Web server after installation without any further manual fine-tuning. We consider installation that integrates with the OS a plus. We give high marks to products that offer an open configuration process.

Management and administration The availability of a dedicated on-console management application is a necessity. Browser-based administration is important for remote management, albeit too clunky a solution to serve as the only option. Administrator access should be more secure than just a dedicated port on TCP/IP. Setting up users and groups should be easy. Being able to import the users and groups set in the

SUITABILITY TO TASK

Product name here

	Power	Ease
Documentation	Poor	Poor
Installation/configuration	Fair	Excellent
Management/administration	Good	Poor
Content and site management	Excellent	Fair
Security	Poor	Good
Web development	Fair	Excellent

N/A—Not applicable: The product does not support this feature.

OS improves a product's marks, as does the ability to update the OS user and group settings from the server.

Content and site management Here we evaluate the tools to create, publish, and manage content on your Web site. Essential programs include a robust HTML authoring tool, an image-map utility, an FTP server, a site-mapping tool, and a link checker. Web servers with content samples, templates, canned CGI scripts, or ISAPI/NSAPI examples receive high ease-of-use ratings. Users should be able to redirect URLs easily, which includes being able to redirect them to another server.

Security Support for SSL 3.0 and digital certificates is practically thought to be a requirement for Web servers today, so products that offer only SSL 2.0 or that don't support digital certificates fare poorly here. You should definitely try to have the option of creating your own certificates, as well as be provided with easy scripts for generating requests to a public certificate authority. Any server that offers additional security by integrating its security into that of the OS receives a high power rating. Support for S-HTTP or an alternative security option such as Challenge/Response or DES tokens is considered a plus.

Web development We examine to what level you can use your Web server as a development platform. We assume CGI support and look for broad support for various APIs, including ISAPI, NSAPI, and WSAPI. Servers should support some form of server-side scripting, such as JavaScript. Additional Web development options, such as Active Server Pages or Notes development, are bonuses. Any tools, samples, or documentation significantly improves a product's ease-of-use rating.

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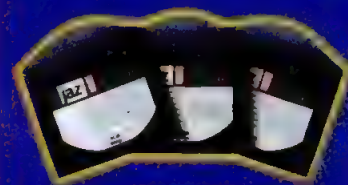
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and IIS's JScript and VBScript. Microsoft and Netscape even offer object-oriented, rapid applications development (RAD) tools for serious developers.

Database connectivity can be a boon for companies that want to provide Web access to sales catalogs, parts databases, or legacy systems. These products offer a range of data-access methods, from raw CGI code to ODBC calls via a scripting language. Most provide database access through an ODBC driver, though in some cases direct data access is faster. Netscape supports direct access to Informix, Oracle, and Sybase; NWS can directly access Oracle; and ICSS supports DB2 databases and CICS transactions.

AND THEY'RE OFF

Though all the Web servers performed well and should suffice for typical access, our testing showed IIS and Enterprise on Windows NT to be the top two performers, often over the scalable Unix-based products. NWS performed admirably, particularly in handling CGI requests with one processor. WebSite struggled in its performance, because its lack of page caching forces every request to read from disk.

Whether for a major commercial Web site or a small intranet, one of these Web servers is the right product for you.

The Apache Project

Apache

Apache 1.1.3, the most widely implemented Web server on the Internet, offers a powerful and customizable approach for any Unix-based server. But Apache's greatest strength is also its biggest shortcoming. Experienced Unix users will enjoy the control they have over the Web server—download Apache and you get all the Apache core and module source code, which can be modified to suit your needs—but creating your own Web server by rewriting code is not what newcomers to Unix are looking for.

Apache runs on most Unix-based machines; we tested Version 1.1.3 on an x86 system running Linux. Installing Apache is not an intuitive process. All of the other Web servers here have installation routines designed to help you set up the serv-

er quickly, but Apache requires a tremendous amount of manipulation before it will run. There is no management interface; all of Apache's power is accessed directly through the text-based Unix shell. This makes Apache difficult to administer locally and impossible to administer remotely from a browser.

Prior to installation, you need to unzip and .TAR the download file to decompress all of Apache's modules into their respective directories. A configuration file must be modified to point Apache to the various available modules. You alter the configuration files manually, adding or removing lines to tell Apache which modules to include with your Web server. After finishing the changes, you compile the final HTTPd server file. Obviously, this means you must bring the server down to reconfigure it.

This system of configuration and installation works well only for someone with Unix experience. The documentation is of little help to an inexperienced user, because it assumes a prior Unix background and strongly implies that if you don't know what you are doing, you should avoid making changes to the files. There is no help available beyond the README files and the comments within the configuration files and source code. Complicating matters for the new user is the fact that there is no official support for Apache. Users with questions must find answers on their own or post inquiries to *comp.infosystems.www.servers.unix*, where many Apache developers field questions.

Setting up users and groups in Apache requires a modification of the source code. The user and group information can be contained in a simple text file or in a database file, but the directives that point Apache at this information are contained in a compiled module. This made it difficult to get Apache to recognize the authorizations we established.

Apache can restrict access by IP address or by enabling basic security on individual directories. You modify configuration files to implement either option. The public-domain version of Apache pro-

vides nothing beyond this basic level of security. Should you require support for SSL encryption, you'll need the commercial version, Stronghold Apache, available from Community ConneXion (reviewed in our issue of September 10, 1996).

Hosting multiple IP addresses on an Apache server is extremely simple. The HTTPD.CONF file contains two directives, Listen and VirtualHost, that enable Apache to perform multihoming with little configuration. The Listen directive tells Apache which port to monitor for a given IP address, and the VirtualHost directive contains the host information for that IP

address. VirtualHost contains additional tags to provide Apache with a host name, root directory, server name, and separate logging information for the server.

Some directives in Apache provide basic site management capabilities, but no utilities are included to handle content creation or management. For basic document moves, Apache's Redirect directive informs the server that a document has been relocated, either permanently or temporarily. URL mapping is handled in a similar fashion through the Alias directive, which provides an alias in the root directory that maps to a document in a separate physical directory. This solution, which works much like URL mapping in WebStar, proves to be equally awkward (albeit secure).

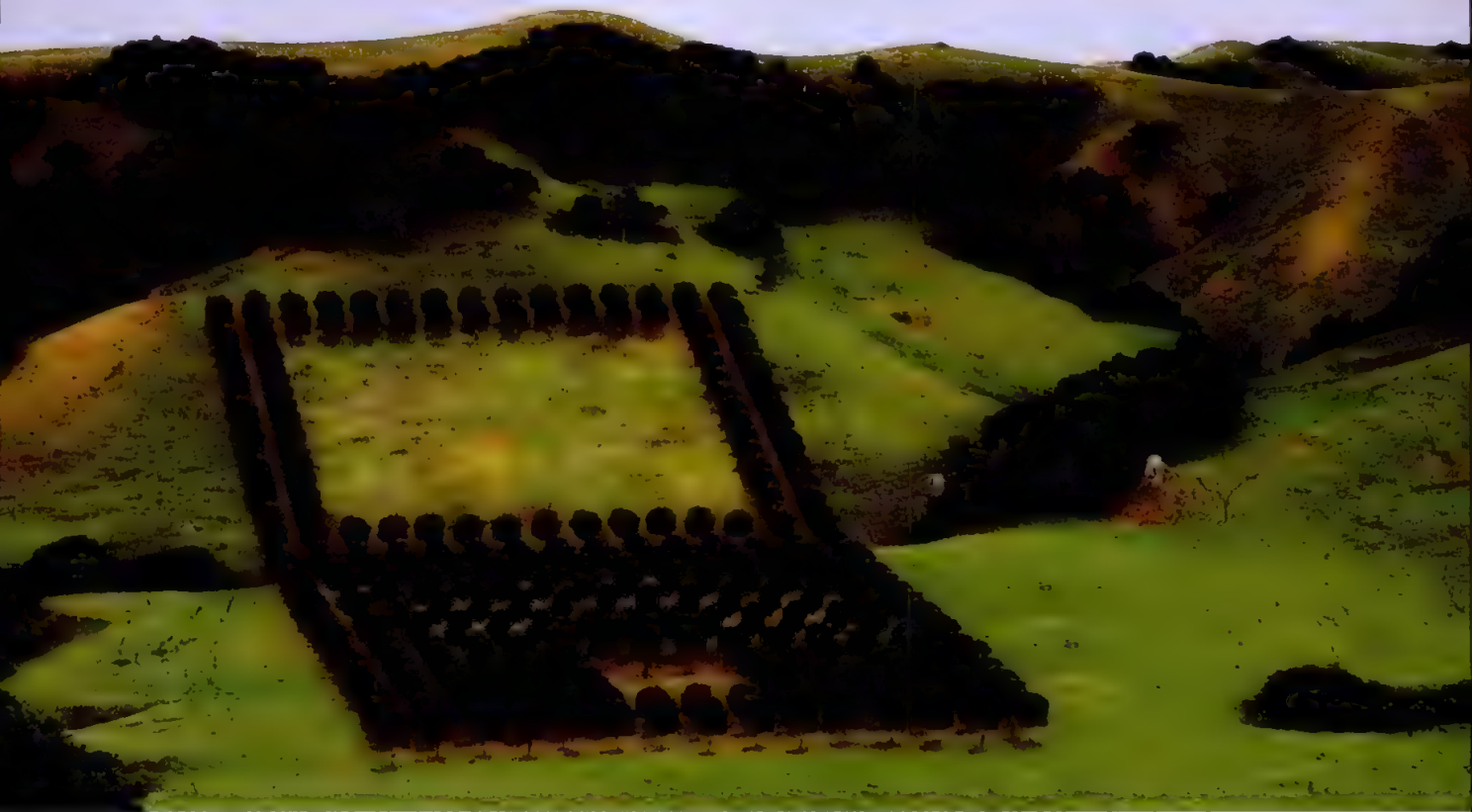
Apache delivered average performance, running behind the major players (like Netscape Enterprise Server) but ahead of the rest. Scaling up to two processors did not significantly change Apache's performance, leading us to conclude that with a high traffic site, Apache at some point will not adequately suit your needs.

Unix gurus will embrace Apache's raw power willingly, reveling in the ability to customize it. The more approachable Enterprise and Netscape FastTrack Server better suit Webmasters who aren't Unix masters but are tied to the Unix platform nevertheless.—Heath H. Herel

Apache 1.1.3. List price: Free. www.apache.org. Circle 448 on reader service card.

SUITABILITY TO TASK		
	Apache	
	Power	Ease
Documentation	Poor	Fair
Installation/configuration	Good	Poor
Management/administration	Good	Poor
Content and site management	N/A	N/A
Security	Fair	Fair
Web development	Fair	Poor

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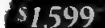
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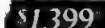
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Operating Systems Supported

Which operating system you run will obviously help determine which Web server you choose. Here's a quick compatibility guide for the major OSs.

■ YES ■ NO	Products listed in alphabetical order	Apache 1.1.3	Internet Connection Server 4.1	Lotus Domino 4.5a	Luckman's Web Commander 1.0	Microsoft Internet Information Server 3.0	Netscape Enterprise Server 2.01	Netscape FastTrack Server 2.01	Novell Web Server 3.0	WebSite Professional 1.1	WebStar 2.0.2
	Windows 3.x	■	■	■	■	■	■	■	■	■	■
	Windows 95	■	■	■	■	■	■	■	■	■	■
	Windows NT Server 4.0	■	■	■	■	■	■	■	■	■	■
	Windows NT Workstation 4.0	■	■	■	■	■	■	■	■	■	■
	OS/2 Warp Connect	■	■	■	■	■	■	■	■	■	■
	OS/2 Warp Server	■	■	■	■	■	■	■	■	■	■
	Mac OS	■	■	■	■	■	■	■	■	■	■
	InterNetWare	■	■	■	■	■	■	■	■	■	■
	Digital Unix	■	■	■	■	■	■	■	■	■	■
	Tru64	■	■	■	■	■	■	■	■	■	■
	Linux	■	■	■	■	■	■	■	■	■	■
	Solaris	■	■	■	■	■	■	■	■	■	■

IBM Corp.

Internet Connection Secure Server

Webmasters of loyal OS/2 sites wishing to implement the most basic of Web servers might consider IBM's Internet Connection Secure Server (ICSS) 4.1. ICSS's lack of site and content management tools and Java support, however, may leave them looking for another package. As we were going to press, IBM Corp. released Version 4.2, which remedies some of 4.1's shortcomings and adds such features as an SNMP agent and HTTP 1.1 PUT support.

Versions of ICSS are available for AIX, HP-UX, Sun Solaris, and Windows NT 3.51 Server and Workstation. ICSS also uniquely offers versions for MVS/ESA and OS/400, but only the OS/2 version is reviewed here. ICSS is also available in nonsecure and export versions.

IBM did not want ICSS to compete against Domino in this roundup, because the products serve different audiences. We could not obtain an evaluation copy from IBM, so we downloaded a full-featured, 60-day copy from IBM's Web site.

SUITABILITY TO TASK

Internet Connection Secure Server

	Power	Ease
Documentation	Fair	Good
Installation/configuration	Good	Excellent
Management/administration	Fair	Fair
Content and site management	N/A	N/A
Security	Good	Good
Web development	Fair	Fair

We had no hard-copy documentation available and were unable to obtain technical support.

We spent under 5 minutes on installation, which requires little user input. Once installed, ICSS displays a default page showing you how to configure the server. Some documentation covering basic features is provided in HTML format—a saving grace.

Webmasters can configure the server from any Web browser or by editing a single text configuration file. After configuration changes are made, the Web server must be restarted. Alternately, you can edit the HTTPD.CNF text configuration file, but you will have to restart the server manually, which you can do by using the supplied command line utility or a menu option on the server console window.

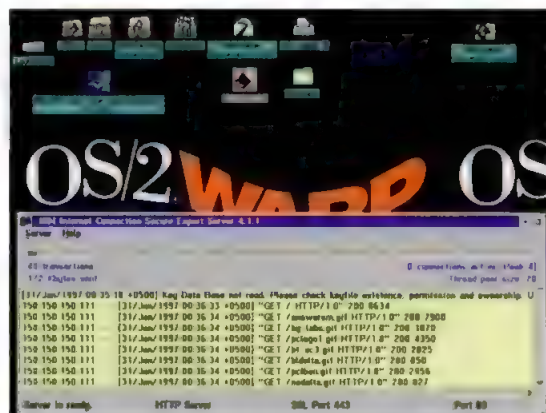
Many of the administration and configuration HTML forms are not user-friendly. Numbered lists display items that are available for editing, but you have to select the item by number from a separate drop-down list box that does not have the description. Other input fields are scrollable but unreasonably small.

A welcome improvement over the previous version is the ability to host multiple Web sites on a single copy of ICSS. Redirecting URLs to other Web servers or even to other physical directories on different servers is simple, as long as the

OS/2 Warp Server itself is attached to the directory.

The logging facility can also be configured to display each log entry to the server window. For a look at how the server is performing, you can open the server window on the OS/2 machine and view such real-time statistics such as the number of transactions, the kilobytes sent, and the active connections.

You can restrict access control to URL mappings by IP address, host name, user-defined protection setups, and Access Control Lists (ACLs). ICSS must be installed on a machine that uses HPFS for its file system in order to support ACLs. The protection setups are confusing to define but are the only method of support for S-HTTP. Without the documentation, we were unable to set up a URL that could grant general read access while denying it only for specific users.



Along with real-time statistics, the ICSS window displays access log entries as they occur.

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Although the secure version of ICSS 4.1 supports only SSL 2.0, Version 4.2 does support SSL 3.0. Both versions support standard encryption schemes and public/private key pairs.

Like Enterprise, ICSS maintains password and group files separately from the operating system. The IDs, passwords, and group memberships of users being added are kept in these two files. Unfortunately, a user can belong only to one group.

ICSS performed near the bottom of the products we reviewed, but it still handled enough connections to be acceptable for most commercial Web sites. Processing around 180 requests per second for static pages with one processor, ICSS may strain under the heavy load of a corporate intranet. IBM says it has improved response time, added multiprocessor capabilities, and increased the number of connections supported in Version 4.2.

On the developer side, ICSS supports CGI, IBM's Internet Connection API (ICAPI), and SSI. NSAPI is indirectly supported through a translation to ICAPI, but you must still compile NSAPI applications for the OS/2 platform. Mysteriously lacking in ICSS is support for Java or Web development scripting languages. (Version 4.2 will support server-side Java.) ICSS does not directly support ODBC and SQL access to many popular databases; you must implement such support through ICAPI.

If you need to publish HTML documents on an intranet at your OS/2 site, or to publish securely over the Internet, ICSS may be for you. For advanced features, however, you should look at a more full-featured product. And if IBM makes good on its claims of performance and feature improvements, Version 4.2 (available at the same \$295 list price) merits a look as well.—*TEC*
Internet Connection Secure Server 4.1. List price: \$295. IBM Corp., Somers, NY; 800-426-7080; www.icss.raleigh.ibm.com/icsserver/. Circle 450 on reader service card.

Lotus Development Corp.

Lotus Domino

Lotus Domino 4.5a, Lotus Development Corp.'s most recent Notes server release, is much more than a Web server. In addition to building on the excellent mail, scheduling, and groupware applications features of its predecessors, Domino integrates Web server capabilities. Domino is an excellent choice for those already using Notes and for those who want the groupware capabilities and dynamic page generation Domino provides as your Web server. But be warned: If you want a traditional, standalone Web server with exceptional speed and page-pumping power, Domino probably isn't for you.

Domino's most impressive feature is its ability to publish information stored in Notes databases over the Web. While most Web servers handle requests for Web pages as simple file transfers, Domino must

add necessary HTML wrappers and perform image conversions (from .BMP to .GIF or JPEG) and other Notes-to-Web conversions on the fly. Also, Domino caches only images.

This may sound like a cumbersome task, but Domino can still handle about 200 static page requests per second. This doesn't compare with some of the eye-popping numbers competitors such as Enterprise garnered in our testing, but this power should suit most Web sites and is pretty good—considering all of the work going on behind the scenes.

Domino uses Notes databases to store documents and applications: e-mail, discussion groups, project tracking, and customized workflow applications are all stored in Notes databases. Domino lets you access these applications via a standard Web browser instead of regular Notes client software, so you can extend the power of your groupware. If you already



Domino's most impressive feature is its ability to publish information stored in Notes databases over the Web.

SUITABILITY TO TASK		
Lotus Domino		
	Power	Ease
Documentation	Excellent	Good
Installation/configuration	Excellent	Good
Management/administration	Excellent	Excellent
Content and site management	Excellent	Good
Security	Good	Good
Web development	Excellent	Good

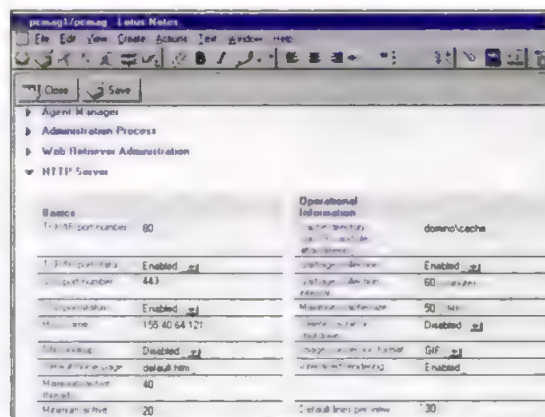
have Notes in place, this feature makes it easy to consolidate applications development efforts to service both Notes and Web users. If you are considering implementing a Domino server, this makes for a great way to push all your groupware applications to the Web. Domino, in fact, was our Editors' Choice in this issue's groupware feature, "Multiple Personalities."

EXCELLENT ADMINISTRATION

The administration features in Domino are excellent. You add new users using the Notes Public Address Book. We were able to add new users and groups quickly and assign privileges to different Notes databases. The Windows NT version of Domino is integrated with Windows NT's User Manager, so entries added to Domino can be copied to User Manager and vice versa.

Domino comes with a separate configuration database from which you can configure multiple host names and map logical URLs to physical directories. Domino also creates standard HTTP-access and error-reporting logs. You can configure Domino to print logs either to a text file (useful if you want to import the file into a third-party Web reporting tool) or to a separate Notes database.

Domino continues Notes tradition of



Domino's easy-to-use configuration screens are integrated with the rest of Lotus Notes.

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PERFORMANCE TESTS

Web Servers



On our tests, Microsoft Internet Information Server running under Windows NT and Netscape servers running under Digital

Unix performed the best overall. In-process APIs such as NSAPI and ISAPI outdid CGI across the board.

What the Numbers Mean

In planning your site, you should consider the kind of content you want to serve up, the hardware platform you intend to use, and the performance of the Web server software you think will best meet your needs.

We ran our benchmark test program, ZD WebBench 1.1, using each of the products. This battery of tests pushes Web servers to the limits of their capabilities, subjecting them to as many as 2,000 hits per second. Although few Web sites will ever see this kind of traffic, high throughput scores on static tests indicate well-written code and more efficient Web server software. In the real world, different users put different demands on their Web servers.

Our Static HTML tests generate page requests for a Web server to process. The clients make requests for the text-only pages, which vary in size from 2K to 128K, following a "test mix" pattern. Microsoft IIS excelled at serving raw HTML pages, even when we increased client loads to unforgettingly high levels. Netscape servers running under Digital Unix and Windows NT performed in the top tier of servers on these tests but leveled off at around 30 clients. IIS kept rising until we added about 50 clients. Novell Web Server (NWS) also performed well here, although it began to level off at around 20 clients.

Netscape servers running under Solaris, O'Reilly's WebSite Professional, Luckman's Web Commander, StarNine's WebStar, IBM's Internet Connection Secure Server, and Lotus Domino made up the second tier of our text-only 1-Processor Throughput (Static HTML) test. Domino's poor performance can be attributed to its images-only caching ability. Because Mac OS cannot handle high server loads,

WebStar finished dead last on our tests.

Also included in our benchmark test suite are the CGI, ISAPI, and NSAPI Processor Throughput test program. These incorporate different levels of CGI, ISAPI, and NSAPI requests, in addition to static page requests. The tests show how well a server can handle pumping out static data while making simultaneous operating-system calls for predetermined sets of information.

When you work with a Web site that contains a lot of database calls or CGI, NSAPI, ISAPI, or WSAPI script, you will notice a much larger drain on your server's system resources. Novell's LCGI, another in-process server extension API, has no direct CGI or API counterpart and is therefore not reflected in our charts. But by including its server extensions in process, NWS gains all of the advantages of other in-process APIs, such as ISAPI and NSAPI, and performs very well in this arena.

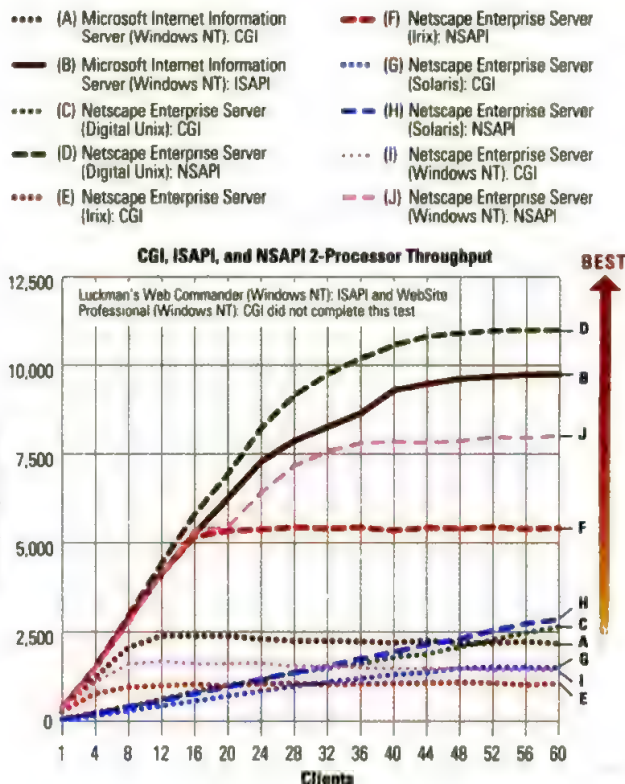
Webmasters of large sites often put all their nonstatic data on other servers so that static data—typically, the home page—gets served as fast as possible out of the cache. The performance advantage of in-process server extensions such as ISAPI and NSAPI makes the argument that for many sites this is not necessary, especially for those having only a few processes—such as advertising banner generators or forms processors—that all users are likely to use.

Enterprise running under Digital Unix performed the best, regardless of client load, with NSAPI added to the mix. IIS under Windows NT with ISAPI and Enterprise under Windows NT with NSAPI also performed well. Even the server fastest at handling

CGI in the mix with static pages, Enterprise under Digital Unix, still performed below Enterprise under Solaris, the worst performer with an in-process API. The tests clearly show the overhead of conventional CGI and the real performance advantage of in-process extensions.

During our testing, we examined products using first one and then two processors. The "WebBench: Performance Gain with 2 Processors" chart shows the percentage of throughput gained, as opposed to actual performance. Note that a product that does well on this chart does not necessarily outperform a product that has a lower percentage gain from one to two processors.

A clear example of this is WebSite, which started at a low performance level but scaled well. Its two-processor throughput, however, still could not match the throughput of some of its competitors, such as IIS,



running on just one processor. If you choose WebSite for its numerous high-quality features and you have performance problems, this test shows that you may be able to remedy them by adding a second processor.

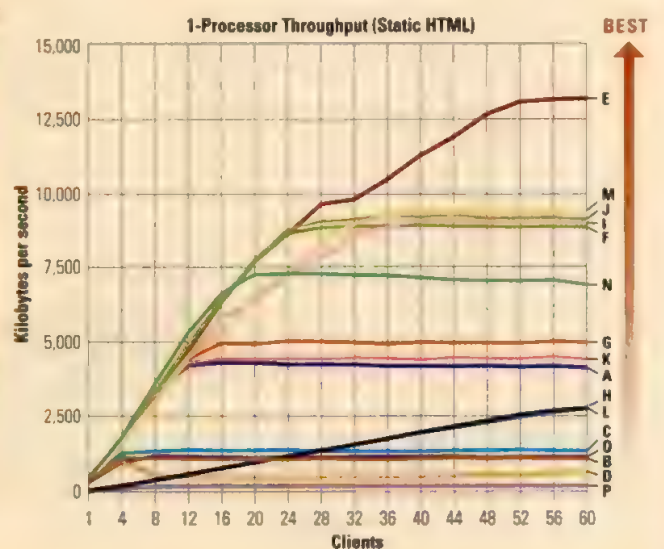
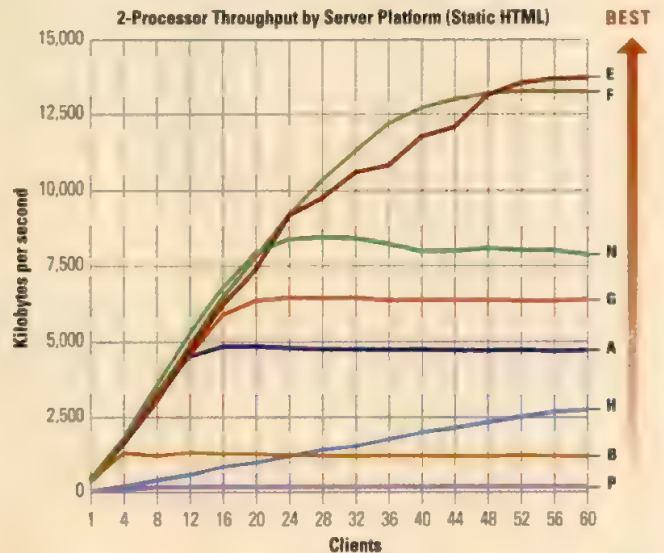
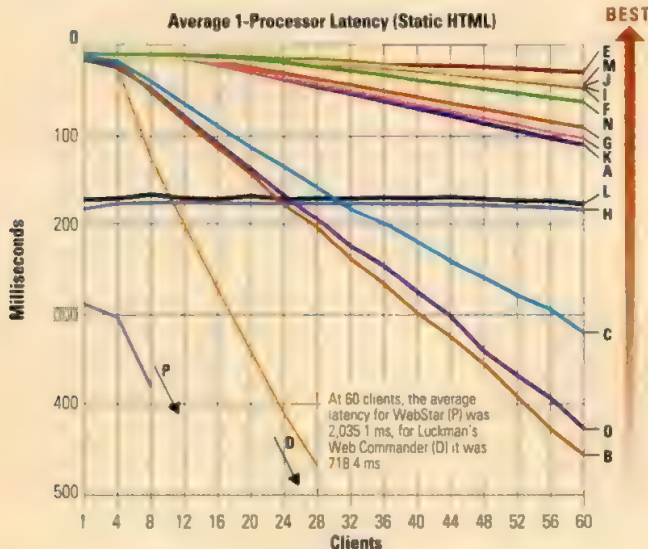
We were surprised at the amount (or lack) of performance increase we got by adding a second processor to most of these products. Since most of them can adequately handle an average-size, average-workload site with one processor, we believe that currently—unless you are seeing over 50 percent processor utilization on a regular basis for extended periods of time—adding a second processor is probably not worth your while.

At the current time, some of the products, such as NWS for IntranetWare and WebStar for Mac OS, are not written to take advantage of a second processor. In the case of IntranetWare, some of the NetWare OS's tasks can be threaded to the second processor—thus accounting for the slight gain in performance when we moved to two processors—while the file and print services, and consequently the Web server software, cannot spawn threads on the second processor. As you will notice, NWS did quite well, performing at or near the top of the charts on all of our tests. Once Novell extends file-serving capabilities to the second processor, providing NWS with multiprocessor capability, watch out: NWS will become one of the better performers, on a par with products running on Digital Unix and Windows NT when serving static HTML. And NWS, with its LCGI server extensions, will possibly perform even better than its competitors. Products designed to run on Mac OS, however, will not fare much better until the OS can

handle spawning additional threads to deal with the increased demand for processing power.

The Average 1-Processor Latency (Static HTML) numbers show the average round-trip time at the client from request to delivery of data. For the most part, the more efficient the server, the lower the latency numbers. As we move from a smaller to a larger number of clients hitting the server at the same time, the latency numbers increase. A flatter, more gradual curve is better, meaning that the server scales well and processes more requests easily. IIS on Windows NT maintained low latencies even under the most stressful circumstances. Although Enterprise performed well here, particularly running under Windows NT and Digital Unix, its latency numbers at 44 clients surpassed IIS's at 60 clients. The glaring exception was Netscape's servers on Solaris, which performed badly—maintaining an almost fixed latency, whether with 1 client or 60. Solaris appeared in our results to be tuned to service all requests in a set (and long) amount of time, whether or not it has the power to go faster. When you consider these results,

- | | |
|--|--|
| (A) Apache (Linux) | (I) Netscape Enterprise Server (Windows NT) |
| (B) Internet Connection Secure Server (OS/2) | (J) Netscape FastTrack Server (Digital Unix) |
| (C) Lotus Domino (Windows NT) | (K) Netscape FastTrack Server (Irix) |
| (D) Luckman's Web Commander (Windows NT) | (L) Netscape FastTrack Server (Solaris) |
| (E) Microsoft Internet Information Server (Windows NT) | (M) Netscape FastTrack Server (Windows NT) |
| (F) Netscape Enterprise Server (Digital Unix) | (N) Novell Web Server (IntranetWare) |
| (G) Netscape Enterprise Server (Irix) | (O) WebSite Professional (Windows NT) |
| (H) Netscape Enterprise Server (Solaris) | (P) WebStar (Mac OS) |



PERFORMANCE TESTS

the poor performance of Netscape servers under Solaris on the server throughput tests makes sense. With a fixed response time, it's logical that server throughput would respond linearly as we added clients. The result of this behavior is a great deal of wasted bandwidth at the server.

Web Commander had some problems finishing a few tests. There were some issues with ISAPI and CGI, which the company was aware of and working on as we went to print. But Web Commander's performance was unusually bad for a Windows NT Server-based product; the fact that it quickly loses ground even with a

sion XPS clients (with Pentium/166 processors, 1GB hard disks, and 16MB of DIMM memory) in two 100-Mbps Ethernet segments of 30 clients each. The network was connected via four Synoptics 10/100 16-port switches. Our benchmark test controller was a Hewlett-Packard NetServer LH Plus with a 166-MHz Pentium processor, 64MB of RAM, and a 2GB hard disk.

For the Intel platforms (Windows NT, IntranetWare, Linux, and OS/2 Warp), we used a Compaq ProLiant 5000 with two Pentium Pro/200 processors, 128MB of RAM, an 8GB hard disk array, and two 100-Mbps NetFlex network interface cards (NICs).

For the Sun Microsystems platform, we chose a Sun Netra with two 200-MHz UltraSPARC processors and two 100-Mbps NICs. This machine had 128MB of RAM and a 4GB hard disk. For the Macintosh platform, we used a Power Mac 8500/180 with 64MB of RAM.

Silicon Graphics provided us with a WebForce Origin 200 system with two 187-MHz R10000 processors, 128MB of RAM, an 8GB hard disk, and two 100-Mbps NICs.

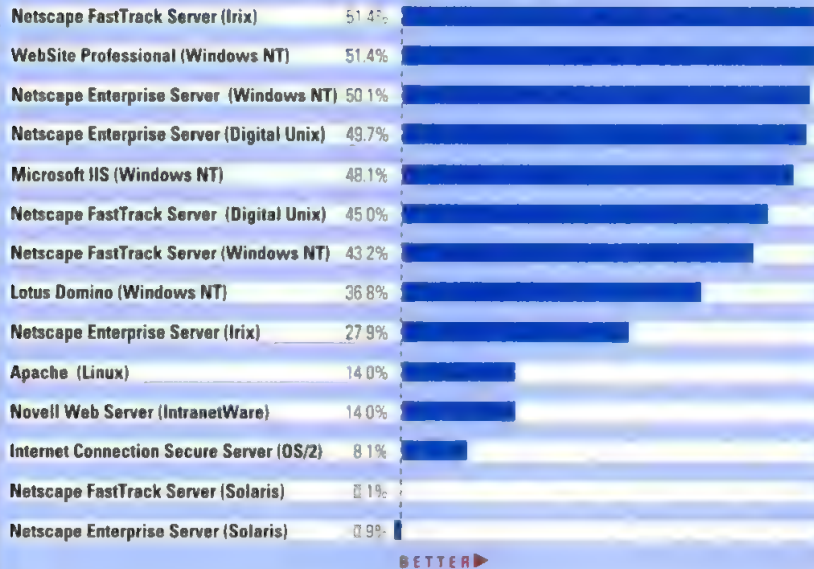
Digital Equipment Corp. provided a Digital Alpha machine with two 400-MHz Alpha RISC Processors, 128MB of RAM, an 8GB hard disk, and two 100-Mbps NICs.

We tested the products using ZD WebBench 1.1, a highly configurable benchmark test suite provided by the Ziff-Davis Benchmark Operation (www.zdbop.com). WebBench 1.1 creates Web server requests by initiating a set of clients with instructions on which pages to request from the server. We used standard test mixes, starting with one client initiating requests to the server, then adding four clients for each test until we reached a total of 60 clients making requests to each Web server.

We used the following Web server software: Apache 1.1.3, IBM's Internet Connection Secure Server 4.1, Luckman's Web Commander 1.0, Microsoft Internet Information Server 3.0 (available with the Windows NT Service Pack 2), Netscape Enterprise Server 2.01, Netscape FastTrack Server 2.01, Novell Web Server 3.0 (beta 3), O'Reilly & Associates' WebSite Professional 1.1, and StarNine's WebStar 2.0.2.

The operating-system software we used comprised Digital Unix 4.0, IntranetWare 4.11, Irix 6.4, Mac OS System 7.5.5, Red-Hat Linux 4.1, Solaris 2.5.1, and Windows NT 4.0 with Service Pack 2.

WebBench: Performance Gain with 2 Processors



Luckman's Web Commander failed the tests due to errors. WebStar does not scale to multiple processors.

Sun worked closely with us to try to resolve the issues around the results we were seeing. But despite the company's help, we were unable to get Netscape servers under Solaris to perform on a par with other versions of Netscape servers or with other servers under other Unix platforms. *PC Magazine* and Sun are still working to remedy these issues for future testing.

Some products, such as O'Reilly's WebSite, have higher latency numbers than others because of the way the Web server handles incoming requests. This product goes to disk to read a fresh version of the requested HTML page every time a request comes in. Going to disk every time a page is requested results in a much slower response time than caching the page right away (but possibly still acceptable). WebStar under Mac OS demonstrated terrible latency increases as the number of clients increased. Mac OS, not coincidentally, is the only operating system in this review with no native thread support, a serious handicap for a server responding to a large number of clients.

small number of clients indicates that Web Commander is fundamentally inefficient.

We found it interesting that Enterprise in particular performed variably on different server platforms. Though it performed extremely well under Digital Unix and Windows NT, its performance numbers were cut almost in half when we moved Enterprise to the Silicon Graphics WebForce Origin 200 system, and for reasons discussed earlier, it performed poorly under Solaris.—*Analysis written by Robert Norton*

How We Tested

Tuning parameters are suggestions a vendor may give you to help its server perform optimally under specific conditions. On our tests, we chose a minimum set of tuning parameters for each product. We turned off the products' logging features when possible and set the number of possible threads to vendor specifications. Your vendor's technical-support staff should be able to figure out the best parameters for your site if you are unsure. Our test-bed consisted of 60 Dell Dimen-

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strong data security. Although it doesn't support SSL 3.0, Domino can self-sign digital certificates, useful for test environments in which it isn't necessary to use a third-party certificate authority. Domino can also act as a local certificate authority and certify key pairs generated by other servers within an intranet environment. The key-generation and certification process can be confusing for most people the first time around, but Domino provides excellent step-by-step documentation.

KEEP IT IN THE DATABASE

One of the more limiting aspects of Domino is that you cannot place any security restrictions on flat files stored outside of Notes databases. Although Domino can serve static HTML pages and execute CGI scripts, the Web development environment in Domino revolves around Notes databases, and Lotus recommends that administrators store Web information in Notes databases rather than in static files.

Still, there are advantages to storing content in Notes databases. For example, you can use Notes replication techniques to create multiple identical sites automatically at different geographical locations within your company. Domino also lets you full-text-index the content in Notes databases, so you can incorporate text searches from either a Web browser or a standard Notes client.

Developers can use the Notes programming environment to create Web sites with Domino. If you are used to more conventional Web-site creation tools and have never worked in Notes, you will be at disadvantage in the unfamiliar territory of the Notes environment. Instead of working with standard HTML tags or conventional hyperlinks, you must use Notes programming concepts to create your Web pages. Once well versed in using Notes' formulas and LotusScript agents, you can create elegant databases.

Most form elements in Notes, such as binary attachments, graphics, and tables, usually map correctly to HTML, but other form elements, such as buttons, don't map smoothly to HTML constructs. Domino's documentation does a good job of outlining which Notes design features are supported and provides recommendations for working around limitations in HTML.

In short, if your primary concern is cre-

ating the kind of collaborative applications that Notes traditionally provides, then Domino is a great tool for moving these applications to the Web.—*John Garris*

Lotus Domino 4.5a. List price: Single-processor edition, \$995; multiprocessor edition, \$2,995. Lotus Development Corp., Cambridge, MA; 800-346-1305, 617-577-8500; fax, 617-693-0968; www.lotus.com. Circle 442 on reader service card.

Luckman Interactive Inc.

Luckman's Web Commander

An interesting mix of features and simple maintenance requirements makes Luckman's Web Commander a solid choice for your small to medium-size Web site. But Web Commander did not perform well against competitors when handling static page requests during testing, and some of the provided accessories are not up to par, so don't look to this server to suit the needs of a major commercial Web site or heavily trafficked intranet.

Like many of the packages in this roundup, Web Commander includes not only a Web server but an HTML editor and other Web development tools. Web Commander also includes a copy of Seattle Lab's mail server, SLMail SMTP/

SUITABILITY TO TASK		
Luckman's Web Commander		
	Power	Ease
Documentation	Good	Fair
Installation/configuration	Good	Fair
Management/administration	Good	Good
Content and site management	Fair	Good
Security	Good	Excellent
Web development	Fair	Fair

menu to kick-start the installer program. Once we got around that hurdle, though, installation took just a few minutes.

The first time you run Web Commander, a configuration wizard walks you through the setup. Web Commander's configuration interface is excellent, providing clear menu choices and helpful instruction messages. One feature we especially like is the program's ability to save each virtual server's configuration data to a file, giving us a backup in case of a disk crash or operator error. There's no remote-administration feature, so all administration must be done at the server.

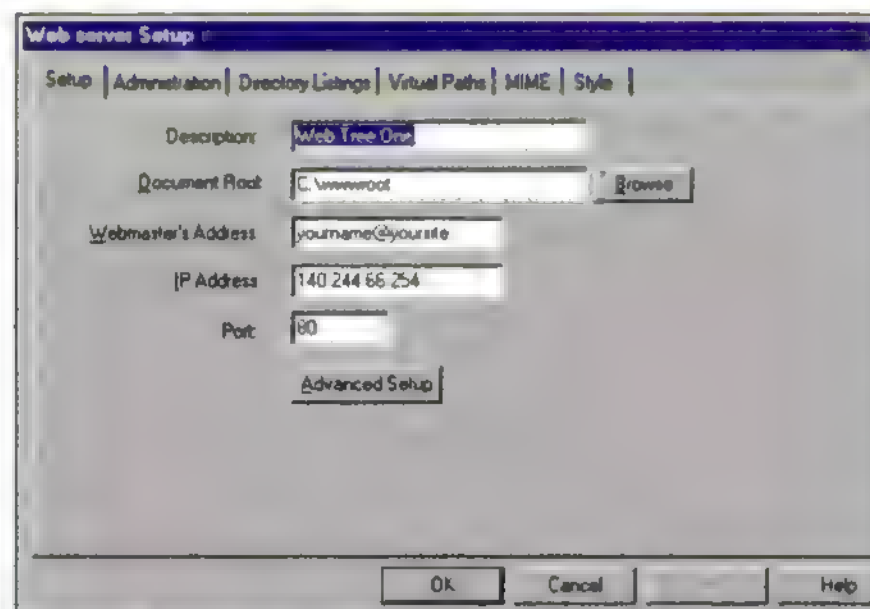
Web Commander provides several types of security. You can restrict access based on IP address or domain names, and you can also require each user to have a unique user name and password. Web Commander does not use the Windows NT user database, so you must manually create an account for each user. Web

Commander does not support SSL 3.0, but it provides S-HTTP as well as a security wizard to help you order a security certificate by e-mail from Verisign or any certificate authority you prefer.

One of Web Commander's unique features is WebCharge, a credit card-verification program. WebCharge accepts credit card information from a user and processes the transaction through one of several online credit-clearing services. When used with SSL or S-HTTP,

WebCharge provides a reasonably secure way to conduct business over the Web.

Luckman Interactive provides several HTML development tools with Web Commander, including WebPage, an automated, wizard-based page generator; WebStudio, a code-based HTML editor; and WebMap, an image-map editor.



The setup dialog for Web Commander's virtual servers allows you to set IP addresses and file locations.

POP3 mail server, and WebCharge, an automated credit card-verification and -clearing program for commercial sites.

Web Commander's single CD-ROM auto-plays under Windows NT, but selecting Setup from the auto-play dialog box returned an error message. We had to run Setup.exe manually from the Start

These products aren't in the same league as Netscape Navigator Gold or Microsoft FrontPage, and some of the provided tools don't work well together. For example, we created a sample page with WebPage and then attempted to review the page with WebStudio. When we opened the file, WebStudio reported that the HTML file had 19 errors. WebStudio itself is awkward, and the program repeatedly crashed during testing. Luckman recently acquired WebEdit, a full-featured, code-based HTML editor, and a Luckman representative told us future versions of Web Commander will include WebEdit in place of WebStudio.

Web Commander includes kits for developing applications in Perl and Java, providing a copy of the Sun JDK and Microsoft's Perl CGI development kit. An ODBC driver and example applications allow access to SQL databases.

Web Commander includes two search engines: Windows 95-based servers use the Wide Area Information Server (WAIS), and Windows NT servers can use the much more powerful Excite search engine. WAIS, which can perform only text-file searches, is much more limited than Excite and requires knowledge of the Perl programming language. Excite is faster and more powerful and can search both text and HTML documents. When we tried to use Excite, though, we discovered that it wasn't installed. Luckman customer support told us that Excite wasn't loaded because the installer program didn't recognize Windows NT 4.0 as being Windows NT and assumed we were running under Windows 95. Because the files on the Luckman CD are stored in a proprietary format, we had to download and install Excite from the Excite Web site.

The product had some difficulties completing tests with ISAPI and CGI. Web Commander performed fairly well with up to about 26 to 30 clients, then simply stopped responding for the remainder of the test. Representatives from Luckman said that they were aware of the problem and feel it occurs only under extremely heavy loads. The company was seeking to remedy this anomaly as we went to print.

Web Commander is a capable package with plenty of promise—if you don't mind working with a few rough edges. As we were completing testing, Luckman an-

nounced a 2.0 release of Web Commander. The new release adds remote administration, a proxy server, and better authenticating tools.—Les Freed

Luckman's Web Commander 1.0. List price: For Microsoft Windows 95 and Windows NT Workstation, \$129; for Windows NT Server, \$249. Luckman Interactive Inc., Los Angeles; 800-711-2676, 213-614-0966; www.luckman.com. Circle 451 on reader service card.

Microsoft Corp.

Microsoft Internet Information Server



Microsoft Internet Information Server 3.0 is a comprehensive solution that will surely help Windows NT take a bite out of the Unix-dominated Web server pie. With perks for both small and large Web sites, IIS 3.0 comes with powerful extras, including Active Server Pages for building dynamic Web pages, Crystal Reports for custom reporting, Microsoft FrontPage 97 for site management, Index Server for advanced searching, and NetShow for on-demand multimedia. On top of that, you can get IIS for free as a download or with the purchase of its required OS, Windows NT Server 4.0.

IIS's tight integration with Windows NT is immediately apparent. IIS uses Windows NT's User Manager to maintain users and groups, saving you the trouble of maintaining multiple sets of network and Web site users. IIS also utilizes Windows NT's Event Viewer and Performance Monitor to view such items as bytes sent per second and current CGI requests.

We found IIS to be an extremely capable performer all around, one that would suit any Web site's needs. IIS performed very well serving static pages and handling ISAPI processing on the server side. Depending on the client load, IIS held its own against or outperformed Netscape servers on any platform with static pages and when we added ISAPI to the mix. IIS began to outshine its competi-

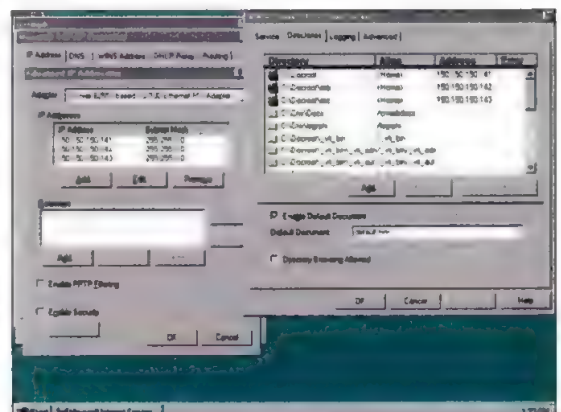
tors as we increased the load to 56 and then 60 clients with static pages, boding well for its scalability. IIS also managed the top performance on our latency tests.

IIS comes with three default services: WWW, FTP, and Gopher. Its Internet Service Manager (ISM) application controls these services on this or any other IIS server on the network. ISM is run from the Windows NT Server or from a Windows NT or Windows 95 workstation. For remote administration, you can run an HTML version of ISM from a browser. Mapping logical URLs to directories is straightforward, but IIS can't map to a directory on another server, a feature Enterprise handles easily.

If you're a Web developer searching for a Holy Grail, IIS and Active Server Pages (ASP) could end your quest. ASP provides an extensive server-side platform supporting compile-free, language-independent scripts and ActiveX components. This, coupled with the fact that IIS returns all ASP requests as standard HTML, lets you create truly dynamic Web sites and online applications accessible by any browser. And yes, IIS now fully supports Java through a Java virtual machine.

Database access has also been extended in this version of IIS. ActiveX Data Objects (ADO), an ASP component, lets developers access and control data in any ODBC- or OLE DB-compliant database using any ActiveX scripting language. Developers can put a Web front end on almost any legacy database without arcane CGI programming.

To tap into the power of ASP and



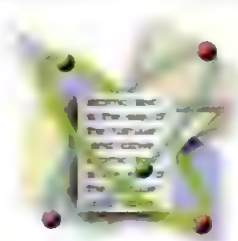
IIS is fully integrated with Windows NT 4.0. The intuitive interface makes creating new URL mappings and virtual servers child's play.

server-side scripting, IIS includes native scripting engines for VBScript and JScript. Server plug-ins are available for other scripting languages such as Perl, TCL, and REXX. You can even use several different scripting languages within a single ASP document.

In case you need to report on the use of your Web server, IIS comes with Seagate Software's Crystal Reports 4.5 for IIS. The resulting presentation-quality reports consist of log-file data returned in standard HTML format, complete with graphs and tables. You can easily customize the various canned report formats to suit your needs.

IIS truly excels at content and site management by way of the worthy FrontPage 97 (an Editors' Choice in our issue of March 4, 1997). The simple-to-use FrontPage editor lets you build complex Web pages and Active Server Pages without having to write a single line of HTML code. Other gems that come with IIS include Index Server 1.1 and NetShow. Using Index Server, you can index and search site content and perform advanced searches on document properties. With the NetShow add-in, you can deliver audio, video, text, and images to users on low-bandwidth networks using multicasting and data-streaming techniques.

Building on Windows NT's security prowess, IIS provides additional levels of security. You can restrict access to a directory or URL by user, group, or IP address, or by using Windows NT's Challenge/Response authentication or SSL 3.0. But unlike Netscape Enterprise Server, IIS cannot limit access by host or domain name.



If you're a Web developer searching for a Holy Grail, IIS and Active Server Pages (ASP) could end your quest

You can get IIS 3.0 on the Windows NT Service Pack 2 CD, or you can download it from Microsoft's Web site. Both versions are direct upgrades from IIS 2.0, which comes with Windows NT Server 4.0.

IIS 3.0 proves that being a Webmaster no longer means you have to be a Unix expert or CGI programmer. Whether you are implementing a small intranet or a large Internet site on a Windows NT platform, this intuitive package could be the Web server for you.—Greg Alwang
Microsoft Internet Information Server 3.0. List price: Free. Microsoft Corp., Redmond, WA; 800-936-4400; fax, 206-936-7329;

www.microsoft.com/iis. Circle 452 on reader service card.

Netscape Communications Corp.

Netscape Enterprise Server



Building on Netscape FastTrack Server's strong foundation, Netscape Communications Corp. scores with Netscape Enterprise Server. Enterprise adds site and content management tools and incorporates a robust Web development platform. Ideal for medium-size to large Web sites requiring sophisticated control over the server and site content, Enterprise performed in the top tier on all of our tests and, under Windows NT, even outdid some of its Unix brethren.

We tested Enterprise not only under Windows NT but also under Digital Unix, Irix, and Solaris. Under Windows NT, Enterprise held its own against the top performers, one of which was Enterprise under Digital Unix. Enterprise also excelled on our test measuring throughput with NSAPI in the mix. Against products supporting two processors, Enterprise under Digital Unix shone above

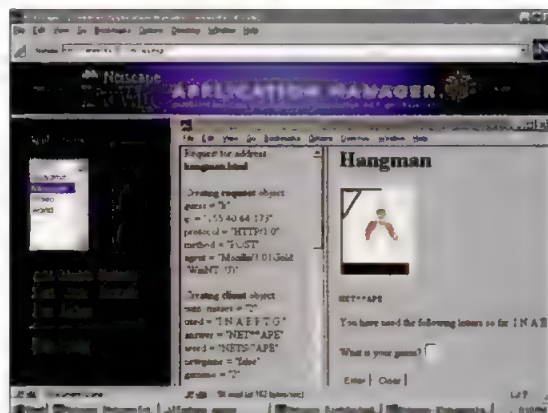
the rest. Surprisingly, Enterprise running under Solaris performed the worst of the bunch on the same test.

After sailing through the effortless installation, you can tweak Enterprise in almost limitless ways—a legacy of its Unix roots—controlling everything from performance tuning to creation of default configuration styles for documents. The management interface runs from any browser that supports frames and JavaScript, letting you manage the server remotely from any client or platform.

Enterprise provides various options for mapping and forwarding URLs and, unlike most of the other servers in this roundup, supports URL redirection to directories on other servers. For large Web sites, Enterprise supports hardware and software virtual servers. Hardware virtual servers must share the same server configuration but can have different IP addresses, and software virtual servers must share an IP address but can have different configurations. To host multiple virtual servers with different addresses and configurations, you must install a separate instance of Enterprise for each virtual server.

Supporting everything from CGI to JavaScript and NSAPI, Enterprise offers a powerful, open development platform. The feature-rich LiveWire module comes with Site Manager and Application Manager. Site Manager resembles Microsoft FrontPage 97, with tools for tracking all site elements and verifying internal and external hyperlinks. It also includes various Web-site templates for creating a complete site from scratch.

Application Manager lets you create, modify, debug, and run a Web applica-



Enterprise's LiveWire Application Manager lets you debug a Web application and step through the code.

SUITABILITY TO TASK

Microsoft Internet Information Server

	Power	Ease
Documentation	Excellent	Good
Installation/configuration	Good	Excellent
Management/administration	Excellent	Excellent
Content and site management	Good	Excellent
Security	Good	Excellent
Web development	Excellent	Excellent

SUITABILITY TO TASK

Netscape Enterprise Server

	Power	Ease
Documentation	Excellent	Good
Installation/configuration	Excellent	Excellent
Management/administration	Excellent	Fair
Content and site management	Excellent	Excellent
Security	Good	Good
Web development	Excellent	Excellent

tion using RAD-like tools. The Debug option is especially useful for tracing and debugging script code. Using LiveWire and Navigator Gold (included), you can author and organize a site, develop and compile scripts, and deploy the application to any destination directory on your server.

Enterprise comes with a 300-page JavaScript Guide to help you get started writing client-side scripts with Netscape Navigator. With JavaScript, you can automate elements on your pages and make them truly dynamic. On the server side, additional JavaScript capabilities let you develop full-blown client/server applications without having to write complex CGI code. For database connectivity, LiveWire provides JavaScript methods for accessing various data types via ODBC. For a more direct approach, you can access Informix, Oracle, and Sybase databases without using ODBC.

Enterprise supports encryption and SSL to ward off eavesdroppers and intruders. Using the Restrict Access option, you can limit access by user, group, IP address, or host or domain name. For increased security, you can enable stronger DES or RC4 ciphers when using encryption. SSL 3.0 gives Enterprise the ultimate in certificate-authenticated security, although the documented procedure for requesting a certificate is confusing at best.

Enterprise maintains users and groups in a .DBM file separate from the Windows NT domain. In order to add a user to multiple groups, you must first add the user, then go back and edit the user's profile.

Enterprise's Catalog lets you present organized views of documents by such categories as title, classification, and author. Netscape also provides a version-control feature to check documents in and out and, if needed, roll back to a pre-

vious version of a document.

Version 3.0 of Enterprise, due out by May 18, will add workgroup-based content publishing and management, sophisticated searching, LDAP support, and intelligent agents that launch from Web server events. In keeping with Netscape's open network environment (ONE) plan, Version 3.0 will provide an even more powerful application framework, with support for enhanced server plug-ins and Internet Foundation Classes.

Netscape Enterprise Server has a lot to offer, and it meets the needs of medium- to large-scale Web sites. This version is starting to show its age against the flashier Microsoft Internet Information Server, but with Version 3.0, Netscape will start the next round well prepared.—GA

Netscape Enterprise Server 2.01. List price: \$1,295. Netscape Communications Corp., Mountain View, CA; 415-937-2555; www.netscape.com. Circle 453 on reader service card.

Netscape Communications Corp.

Netscape FastTrack Server

A scalable, cross-platform Web server suitable for an intranet workgroup setting or a midsize Web site, Netscape FastTrack Server offers great performance, ease of use, and excellent security. Although FastTrack lacks the integrated development tools of such products as Lotus Domino, it does provide open development interfaces that make it appropriate for more advanced Web applications. But for more sophisticated options, such as text searching, advanced site management, and document versioning, you'll have to purchase an add-on or look to a higher-end product, such as IIS or Enterprise. Still, if you need to deploy a mix of Windows NT and Unix servers quickly, FastTrack is an ideal choice.

FastTrack's straightforward installation and configuration processes are nearly identical across platforms. FastTrack

runs on a number of Unix platforms, as well as on Windows 95 and NT. We tested FastTrack under Windows NT, Sun Solaris 2.5.1, SGI Irix, and Digital Unix. To install FastTrack under Windows NT, we simply ran a setup utility and answered a few basic questions. During installation, the utility configures a special HTTP server used to configure and manage additional FastTrack Web server processes.

Administrators then create Web servers by accessing this server port using Navigator Gold.

You don't need to be a Unix expert the way you do with Apache to set up and administer FastTrack. A concise Administrator's Guide walks you through installation. Merely copy the .TAR file to a directory, extract the installation files, and then run a simple Unix shell script.

After the initial setup, you configure FastTrack by accessing a Web application called the Netscape Server Manager (NSM) from within Navigator Gold.

This browser-based approach has pros and cons. On the positive side, remote administration is easy. You can specify the remote IP addresses or host names from which FastTrack will accept requests to modify server parameters—particularly useful in multiserver Web environments.

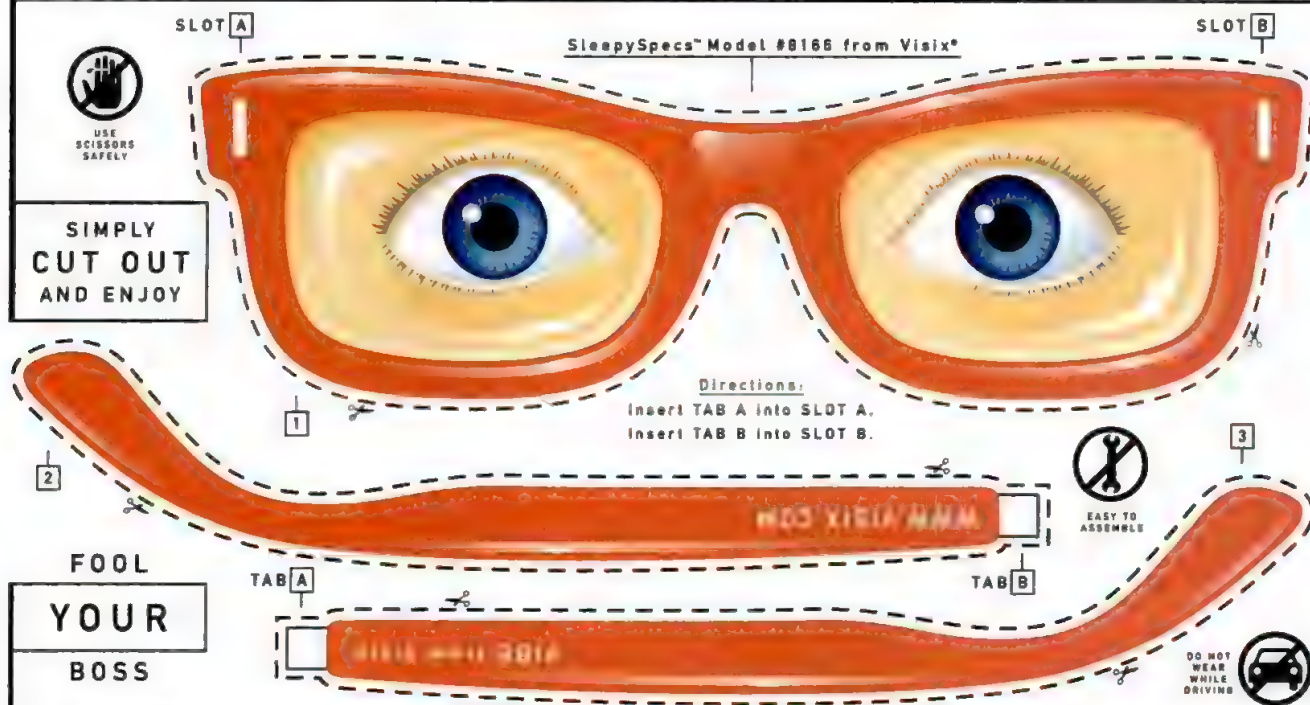
On the downside, Web-based interfaces aren't as flexible as native GUI interfaces. Although NSM incorporates new Web technologies, the inherent limitations of HTML make the user interface unappealing at times. You can't drag and drop users into groups, for instance.

Once you get used to the interface, though, you'll appreciate FastTrack's configuration options. Small ISPs using FastTrack to provide multiple domains will welcome the support of virtual servers, which let you map multiple host names either to a single IP address or to multiple addresses (most servers map multiple host names only to multiple IP addresses). Unix requires a bit more tweaking than Windows NT when dealing with more than one IP address, so before configuring any virtual servers, you



FastTrack's security supports all six ciphers in SSL 2.0 and 3.0, as well as Challenge/Response Authentication.

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should make sure the network interface card and driver are fully configured for multiple TCP/IP addresses.

FastTrack maintains its own user database separate from the operating system, so adding users to the system is not as easy as it is with IIS or Novell Web Server. Having a separate user database does, however, provide you with complete con-

and forwarding, eliminating the need to change all the links in each HTML document as your site grows and changes. We found that the setup of these features was quite easy.

THE PERFORMANCE STORY

FastTrack ranked among the fastest performers in this roundup. Under three of the four FastTrack platforms we tested, FastTrack scored just a notch below the fastest performer, IIS.

We were especially impressed by the Windows NT version of FastTrack. The Digital Unix version was the best performer in most cases, but the Windows NT version significantly outperformed the SGI and Sun Solaris versions on most tests.

For static files, the Digital Unix and Windows NT versions of FastTrack performed almost identically, with performance

increasing steadily through 40 clients before leveling off. The SGI version of FastTrack leveled off at 20 clients, and at high client loads performed about half as well as the Digital Unix and Windows NT versions. FastTrack under Solaris performed poorly, generating less than half the throughput of the SGI version.

The Digital Unix port was the best performer during our server-side processing tests, followed closely by the Windows NT port. Although FastTrack under Windows NT performed the best on our CGI test at low client loads, the Digital Unix version did better at high client loads (more than 32 clients). The Unix versions showed steadily increasing performance as we increased the number of clients, but the Windows NT version peaked quickly, at 8 clients.

On the NSAPI test, the Digital Unix version was clearly the fastest, outperforming the Windows NT version by about 30 percent. Similar to the results on the static file test, the Solaris version fared poorly—handling only about one-quarter

the requests per second that the Digital Unix version did. All the products, however, performed significantly better on the NSAPI test than the CGI test, demonstrating the performance gains possible when using the higher-performance Netscape interface.

Finally, we found that adding a single processor resulted in considerable performance gains, regardless of platform. When we added a processor to the underlying hardware for each platform we tested, we saw performance gains of about 50 percent on each of the three tests.

FROM WEB PAGES TO WEB APPS

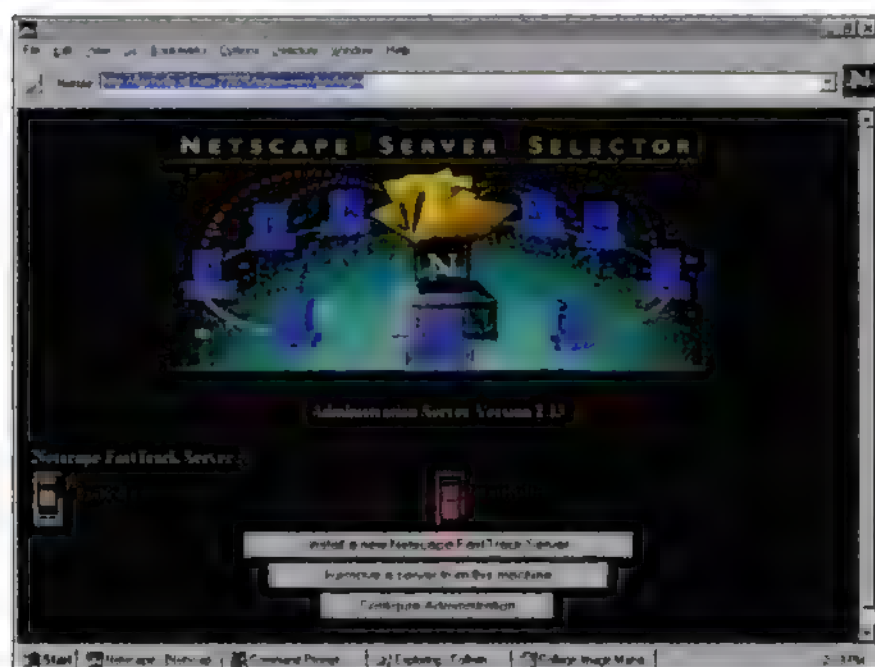
FastTrack supports a number of programming interfaces that significantly extend the power of the Web server, but the server comes with few tools for Web developers. One included tool is Navigator Gold, an adequate WYSIWYG HTML authoring tool for creating simple Web pages.

FastTrack does offer features for serious Web developers. At the most basic level, FastTrack can execute CGI scripts, WinCGI, and Server Side Includes (SSI)—industry-standard protocols for implementing server-side programming logic. FastTrack also includes a server-side Java interpreter to let developers write Java applications that launch from the Web server in response to Web requests.

C programmers who need flexibility from a Web server can use NSAPI to modify FastTrack's core functionality. NSAPI is a server extension that lets developers implement custom routines that override the basic processes

involved when FastTrack handles an HTTP request. NSAPI is a higher-performance alternative to CGI, because NSAPI code is linked directly into the Web server process—unlike a CGI script, which is executed as a separate server process.

FastTrack joins ease of use with a variety of hooks for more sophisticated Web development. Cross-platform support makes FastTrack suitable for both work-group-level Windows NT environments



FastTrack's server administrator manages all virtual servers remotely or locally.

trol over each user and group. And once the users are in the system, setting up groups and changing access rights are straightforward.

SOLID SECURITY

FastTrack's security is one of the most comprehensive among the products we reviewed. It supports all six ciphers in SSL 2.0 and 3.0, as well as Challenge/Response Authentication. As an additional client-side security measure, FastTrack supports a new HTML directive that prevents caching preencrypted files to the client.

Netscape provides a utility to generate the public-key/private-key pair. We found the key-generation process easy and the documentation's description of Web server security issues particularly helpful.

Setting up SSL for Unix is no trivial task. You run a Unix shell script to generate the key pairs, then execute an application from the browser to create the key files. After you fill out an online certificate request form, the system generates an e-mail to the certificate authority (CA). Once you get the certificates back from the CA, installing them and enabling security is easy.

To assist in load balancing and security, FastTrack supports URL redirection

SUITABILITY TO TASK		
Netscape FastTrack Server		
	Power	Ease
Documentation	Excellent	Excellent
Installation/configuration	Excellent	Excellent
Management/administration	Excellent	Fair
Content and site management	Good	Good
Security	Good	Good
Web development	Good	N/A

from a Web server can use NSAPI to modify FastTrack's core functionality. NSAPI is a server extension that lets developers implement custom routines that override the basic processes

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and enterprise sites running multiprocessor Unix servers. FastTrack may lack some of the high-end features of Enterprise or IIS, but it will be relatively simple for Unix traditionalists to administer. All in all, FastTrack is an excellent and reliable entry-level product.—*John Garri* and *Robert L. Morrison*

Netscape FastTrack Server 2.01. List price: \$295. Netscape Communications Corp., Mountain View, CA; 415-937-2555; www.netscape.com. Circle 453 on reader service card.

Novell Inc.

Novell Web Server



If you are looking for an easy way to turn your existing NetWare 4.11 server into an intranet server, Novell Web Server (NWS) 3.0 is your only choice. With greater performance, an integrated search engine, SSL 3.0 support, and enhanced database connectivity, Novell's new Web server is a vast improvement over Version 2.51 and provides an ideal platform for corporate intranets. Just don't expect flashy site and content management tools. As we went to press, Novell and Netscape partnered for the formation of a new company, Novonyx, which will deliver Netscape SuiteSpot-based products for NetWare. Novell says it will continue to develop the NWS line.

Although NWS 2.51 is still bundled with IntranetWare, we tested the beta 3 release of NWS 3.0, which is available as a free download at Novell's Web site. IntranetWare comes with other modules to help round out your intranet arsenal, including an FTP server, a DNS server, a DHCP server, an IP/IPX gateway, a multiprotocol router, and Navigator 2.01.

The beauty of NWS is that you can use your existing NetWare server and avoid the cost of a separate Web server. A minimum NetWare configuration with NWS needs only 32MB of RAM, though you may want to add memory to your server for better performance.

Unlike the new release of IIS, NWS 3.0 is not a patch, so you don't have to install Version 2.51 first. Just configure your server for TCP/IP and use NetWare's INSTALL.NLM to load the

NWS modules; your NetWare server transforms into an intranet server in minutes. The online documentation is improved but is still not as comprehensive as WebSite Professional's or IIS's.

NWS excelled on our performance tests, especially when you consider that it threads to one processor only. NWS processed about 800 requests per second for static HTML, landing just slightly behind the pack leaders. Even when compared with products that could scale to two processors, NWS held its own, trailing only the best performers. NWS delivered the highest throughput of all the products when handling CGI requests in the mix of static HTML pages, even outperforming products supporting two processors.

NWS integrates fully with NetWare Directory Services (NDS), easing the administrative burden considerably by centralizing the management of users, groups, and NDS objects under one NDS management umbrella, similar to Microsoft's implementation in IIS. A convenient NDS browser utility allows you to view all objects in the NDS tree from a standard Web browser—a blessing for administrators of large, distributed LANs with many NDS objects. You control intranet access for members of the NDS tree using familiar NetWare rights and restrictions. For users who are outside the NDS tree, you can restrict access by IP address, physical network address, or domain name.

Support for SSL 3.0 encryption in NWS augments NDS's already tight security by requiring authentication at the server, the client, or both. Creating keys with the key manager and administering SSL is easier than with FastTrack or Enterprise. But NWS lacks extended support for a variety of encryption keys.

Although NWS supports traditional URL redirection and forwarding, Version 3.0 adds a new twist. Now you can store Web pages on any NetWare server on your network, regardless of whether it is configured as a Web server. This lets you

distribute your intranet resources among several servers, offloading your main intranet server. Also new to NWS 3.0 is the ability to host an unlimited number of virtual servers or domains. You can now departmentalize your intranet resources for easier Web management.

You control all aspects of any NWS-enabled Web server on the network using the WEBMGR .NLM management module. It is similar to other conventional Novell utilities, so NetWare administrators can get up to speed quickly. We found the context-sensitive help system in WEBMGR to be quite capable. Not surprisingly, WEBMGR requires Novell's client in order to run;

Microsoft Windows 95 Client for NetWare will not work.

On the development front, NWS supports applets written in Java. For more experienced developers, NWS provides its own flavor of CGI, called LCGI (Local CGI), which can be used to develop NLMs for running server-side Web applications. Perl developers will feel right at home with Novell's Perl 5 script interpreter, which runs as an NLM on the server. For advanced scripting, NWS comes with Net-



Now you can store Web pages on any NetWare server on your network, regardless of whether it is configured as a Web server.

SUITABILITY TO TASK

Novell Web Server

	Power	Ease
Documentation	Good	Fair
Installation/configuration	Good	Excellent
Management/administration	Excellent	Good
Content and site management	Good	Good
Security	Good	Good
Web development	Good	Fair

Basic, a 4GL scripting environment geared toward RAD. If you need to provide access to your Oracle database via the Web, NetBasic includes function classes for connecting directly to Oracle 7 databases.

Novell's new QuickFinder is a full-featured search engine that lets you add search capabilities to your intranet easily. You can utilize the power of the search engine in your Web applications using the QuickFinder API in conjunction with NetBasic.

SUMMARY OF FEATURES

Web Servers



■ YES ■ NO

Products listed in alphabetical order

	Apache 1.1.3	Internet Connection Secure Server 4.1	Lotus Domino 4.5a	Luckman's Web Commander 1.0	Microsoft Internet Information Server 3.0	Netscape Enterprise Server 2.01	Netscape FastTrack Server 2.01
List price	Free	\$295	\$995 (single-processor edition)	\$249	Free	\$1,295	\$295
Provides virtual servers	■	■	■	■	■	■	■
Automatic URL redirection/Multiple ports	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Can scale to multiple processors	■	■	■	■	■	■	■
Includes browser	■	■	■	■	■	■	■
Supports URL redirection to other servers	■	■	■	■	■	■	■
Can act as proxy server	■	■	■	■	■	■	■
Built-in search engine	■	■	■	■	■	■	■
User can shut off directory indexing	■	■	■	■	■	■	■
SNMP agent included	■	■	■	■	■	■	■
HTML authoring/image map-builder utility	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Web site management tools	■	■	■	■	■	■	■
Supports HTTP 1.1 Put	■	■	■	■	■	■	■
Configuration and Management							
Web server can be managed from:							
Server console/Web browser	■ ■	■ ■	■ ■*	■ ■	■ ■	■ ■	■ ■
Performance utility monitors:							
Current connections	■	■	■	■	■	■	■
CGI and other API requests	■	■	■	■	■	■	■
Bytes sent/received	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Configuration files stored in Registry/directory	N/A† ■	N/A† ■	■ ■	■ ■	■ ■	■ ■	■ ■
Logging							
CERN/NCSA common log format	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Reporting tools	■	■	■	■	■	■	■
Logs access/page hits	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Customizable log files	■	■	■	■	■	■	■
Logs to ODBC/SQL databases	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
CGI scripts can create their own log entries	■	■	■	■	■	■	■
Log entries identify browser	■	■	■	■	■	■	■
Security							
Password/challenge-response authentication	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Supports SSL v.3	■	■	■	■	■	■	■
Access control handled by OS	■	■	■	■	■	■	■
Access control handled by by server	■	■	■	■	■	■	■
Access control handled by domain name/IP address	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Can control access to documents	■	■	■	■	■	■	■
Can control access to parts of documents	■	■	■	■	■	■	■
Creates private certificates	■	■	■	■	■	■	■
Scripts or wizard for creating certificates	■	■	■	■	■	■	■
Applications Development							
CGI/winCGI	■ N/A†	■ N/A†	■ ■	■ ■	■ ■	■ ■	■ ■
Server-side Java/Server-side JavaScript	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
ISAPI/NSAPI	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Other APIs	None	ICAPI	ICAPI, Notes API	None	Active Server Pages, ActiveX, ADO	Session Management, Database access	Session Management, Database access
Allows SSIs (Server Side Includes)	■	■	■	■	■	■	■
Service and Support							
Online/toll-free telephone technical support	■ N/A†	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Free telephone-support period	N/A†	None	30 days	3 incidents	None	90 days (for installation only)	90 days (for installation only)
Technical-support hours (eastern time)	N/A†	8:00–5:00 M–F	8:00–8:00 M–F	11:00–8:00 M–F	24 hours, 7 days	8:00 A.M.–10:00 P.M. M–F; 11:00–8:00 Sat., Sun.	8:00 A.M.–10:00 P.M. M–F; 11:00–8:00 Sat., Sun.

* The user can manage Lotus Domino from the client. N/A†—Not applicable: This feature is relevant only to Windows-based applications. N/A†—Not applicable: Apache does not have telephone support.

SUITABILITY TO TASK

WebSite Professional

	Power	Ease
Documentation	Excellent	Excellent
Installation/configuration	Excellent	Excellent
Management/administration	Good	Good
Content and site management	Good	Excellent
Security	Good	Excellent
Web development	Good	Excellent

The trace option lets you log 11 different server activities selectively, including CGI execution, authentication success, and network I/O throughput.

WebSite offers Web developers a full suite of programming interfaces, including CGI, ISAPI, server-side Java, Visual Basic, and O'Reilly's own WSAPI. The Cold Fusion Web applications development tool that comes with WebSite provides on-the-fly access to ODBC and SQL databases, and several query examples make it easy to develop your own database front end. O'Reilly provides software development kits for WSAPI and Cold Fusion, as well as a sample Web site with working examples of all the programming interfaces. The well-documented example programs include links to additional programming resources on O'Reilly's own Web server.

WebSite also includes content-creation tools that don't require any programming. The indexing tool WebIndex builds keyword index files that can be searched with a companion CGI program, WebFind. You create the index with WebIndex, then create a link pointing to WebFind on any Web page. Users fill in a form using WebFind to locate any keyword in the index. WebSite also includes a copy of the excellent HotDog HTML editor, an image-map editor for creating clickable image maps, and a URL link checker.

WebSite delivers a complete suite of tools to build and manage a Web site, although its performance was not quite at the same level as Microsoft's and Netscape's offerings. WebSite performed admirably when delivering static HTML and acceptably when we added CGI into the mix of page requests. It scaled well as we added clients, improving slightly but steadily as the load increased. WebSite's numbers never approached those of its prime competition, although it can probably handle the loads adequately for

today's most heavily trafficked sites.

Although WebSite Professional landed in the bottom tier during testing, it is one of the most complete, capable, and usable Web server packages on the market. Its completeness, flexibility, and excellent management features make it a reasonable choice for corporate intranets and ISPs.—LF

WebSite Professional 1.1. List price: \$499. O'Reilly & Associates Inc., Sebastapol, CA; 800-998-9938, 707-829-0515; fax, 707-829-0104; software.ora.com. Circle 455 on reader service card.

StarNine, a division of Quarterdeck Corp.

WebStar

Turning your Mac into a Web server has never been easier than with StarNine's WebStar 2.0.2. Clearly the server of choice for the Mac platform, WebStar adds performance and features that take it well beyond its predecessors. But the Mac platform still falls far behind other platforms, such as Windows NT and the Unix varieties, so those starting from scratch should not go with WebStar.

You can handle server administration from the server console or remotely via any Web browser. The administration utility lets you monitor server activity and maintain site security, default server settings, and plug-ins quickly and efficiently. The server application offers a tremendous amount of information, but much of that is on one small screen, making it hard to find information quickly. On the other hand, WebStar's browser administrator makes excellent use of screen space, letting you navigate easily through available functions, unlike Netscape's unwieldy browser interface.

Security within WebStar is quite simple. We quickly set up security parameters, known as *Realms*, and assigned users to them with little extra work. Existing lists of users can be imported into WebStar directly, saving you data entry. An Allow/Deny feature lets you restrict access by IP address or domain name. You can also apply restrictions to individual Realms, so you can permit clients outside a Realm to view docu-

ments that are otherwise restricted.

For added security, WebStar/SSL ships as part of the basic package. We easily generated a key pair, a Digital ID request, and the Digital ID itself once the key request had been processed. The SSL Server is a separate application but runs simultaneously with the primary Web server to allow secure and nonsecure access to your site.

You can build, extend, and maintain your Web site with the tools and functionality included. StarNine provides a copy of Adobe PageMill for the easy creation and maintenance of Web sites. WebStar includes support for server-side Java, SSI, and CGI, as well as the unique WebStar API (W*API). Like ISAPI and NSAPI, W*API allows you to develop server-side plug-ins that boost the performance of the server. The CD-ROM includes documentation on the W*API as well as on the full SDK.

Installing plug-ins is as simple as dragging and dropping them into WebStar's plug-ins folder and restarting the server. Several useful plug-ins included with WebStar add capabilities to your server without the need for CGI programming.

Even the best Web servers on the Mac platform will lag behind other servers under Windows NT and the sundry Unix platforms we evaluated, because you cannot scale to two processors to achieve better throughput. WebStar performed especially poorly when we added CGI into our page requests, and it posted the worst latency numbers in this roundup.

WebStar is not without its feature limitations either. Setting up logical URL paths proved cumbersome, as all refer-



WebStar's administration utility allows you to monitor server performance at a glance from any Web browser.

INTERNET Web Servers

ences must be relative to the WebStar folder. Documents can reside in other folders, but aliases for each document—with identical document names—must be placed in the WebStar folder hierarchy. Though laudable from a security standpoint, this makes mapping to external documents unnecessarily tiresome.

Because the Mac OS is unable to handle multiple IP addresses, WebStar's multihoming capability is limited. As a remedy, StarNine suggests routing the multiple hosts to a single IP address and then speci-

SUITABILITY TO TASK

WebStar

	Power	Ease
Documentation	Good	Excellent
Installation/configuration	Good	Excellent
Management/administration	Good	Excellent
Content and site management	Fair	Good
Security	Good	Excellent
Web development	Good	Good

ifying a unique home page for each host, placing the documents for each host in unique trees, or running multiple copies of the server, each with its own configuration.

Many of the features one hopes to find in a Web server, such as database connectivity and site/content management tools, are available only through third-party add-ins—but a wealth of such tools exist for WebStar. StarNine includes many demos of add-ins on the CD-ROM.

You can get WebStar on CD-ROM, on disks, or as a full-featured, time-limited download. The product's streamlined installation checks for the existence of MacTCP and AppleScript and installs these Control Panels automatically if they don't exist. The manual, though relatively thin, is detailed—providing clear instructions on how to install and configure WebStar to meet your needs.

In a market dominated by Unix and Windows NT, StarNine has provided Macintosh users with the power to command a segment of the Internet. Other servers have more to offer, but for anyone accustomed to working on the Macintosh platform, WebStar is an invaluable addition to your Internet toolkit.—HHH □
WebStar 2.0.2. List price: \$499. StarNine, a division of Quarterdeck Corp., Berkeley, CA; 800-525-2580, 510-649-4949; fax, 510-548-0393; www.starnine.com. Circle 456 on reader service card.

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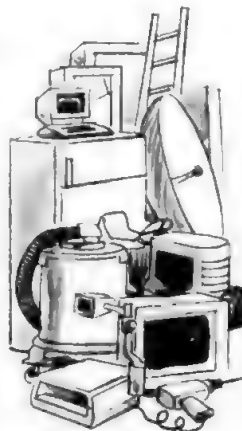
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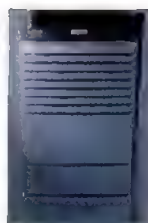
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PC Tech

THE DEFINITIVE GUIDE TO PC TECHNOLOGIES & TOOLS

Can We Chat?

IRC offers the most immediate way to communicate over the Internet.

By Neil Randall



Everybody uses e-mail, and most Internet users have been on Usenet newsgroups or visited the forums in CompuServe or AOL. But despite the strengths of these technologies, they share one major limitation: They're not real-time. E-mail and Usenet are messaging systems, and although they can approximate the feel of conversation at times, they lack the true spontaneity of live interaction. In some ways, that can be an advantage—people can compose and read messages as their schedules allow—but we all know that sitting around a table talking with one another has a lot of advantages, too.

Enter Internet Relay Chat, better known as IRC, or more recently as Live Chat or just Chat. Originally designed by Jarkko Oikarinen in Finland in 1988, IRC has developed into an increasingly popular Internet activity. Lending emphasis to its popularity are Microsoft's development of Internet Chat Server (www.ms-normandy.com) for its Internet Information Server 3.0 and Netscape's deal with IChat (www.ichat.com) to provide Chat services directly through the Navigator browser. Microsoft also offers two Chat clients, V-Chat and Comic Chat, and Netscape includes a Chat client in the Power Pack 2.0 add-on to Navigator (www.netscape.com/comprod/power_pack_summary.html). This isn't to suggest that Microsoft and Netscape offer the only solutions—in fact, they're quite late to the party with this technology—but the fact that the biggies have noticed shows pretty convincingly that IRC has made its mark and is here to stay.

YET ANOTHER CLIENT/SERVER ARRANGEMENT

As with just about every other Internet technology, including e-mail and the Web alike,

IRC operates on a client/server basis. A computer connected to the Internet full-time (the server) hosts IRC connections, and users anywhere in the world connect to that machine through a piece of special software (the client) to take advantage of what the server offers. That would be completely ineffective if only one client could connect at any given time, but again, as do other Internet technologies, IRC servers allow multiple simultaneous connections. With this in mind, the principle behind IRC is quite simple: More than one person is connected to the same machine, so let them all talk to one another.

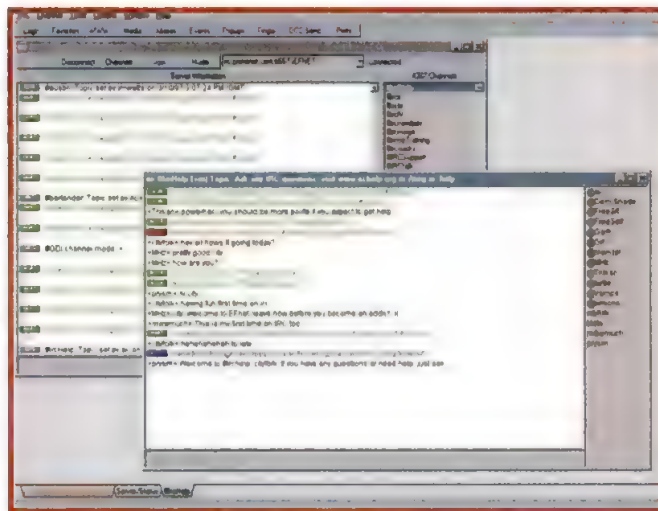


FIGURE 1: The PIRCH Internet Relay Chat client displays windows for your chat session and connection status messages, complete with color-coding.

In a way, it's a bit like George Carlin's viewpoint about telephone callers on hold. Why, he wonders, can't everyone on hold be linked together, so they have someone to talk to? Nice idea, and certainly something that download sites especially should think about. If you and ten other people are simultaneously downloading software from TUCOWS, why not chat it up while you're waiting?

IRC wasn't the first real-time communica-

tions tool on the Internet. Before it came along, Unix users had access to a program called Talk (it's still available). But Talk has a very limited feature set, and only two people can be connected to one another at any given time. IRC goes far beyond these limitations, not only in allowing more than two simultaneous users, but in making a wide range of other features available as well. These features include nicknames, public or private discussions, channels and rooms, and the ability to kick offensive users off a server and even to deny them future access.

IRC made its early reputation as a technology for socializing, but over time it has developed uses in business as well, particularly in the areas of technical support and customer service. It's possible for businesses to set up their own Chat networks (see below for a discussion of IRC networks), but they can also make use of the existing networks and restrict participation.

ALTERNATIVES TO IRC

There are also newer systems offering live chat over the Web, through Java applications, or through chat rooms on AOL or other proprietary online services. Running a Chat server on an existing intranet or extranet server allows companies to offer live interaction among employees and associates, and public chat areas let organizations host discussions across the Internet.

Web sites such as events.yahoo.com help you find live chats. Many are restricted to specific times and dates. Some occur on IRC channels, while others take advantage of the Web-based systems, and in fact a site like the Web Broadcasting Server (hwbs.net) offers continuous Web chat rooms on a variety of business and news topics. Still other Chat services are Java-based, with Java Chat clients handling the user input. An exam-

ple of this is Talk.Com (www.talk.com), a service from the popular HotWired site.

THE FEEL OF INTERNET CHAT

IRC is like a Usenet group on stimulants. Communication is fast, brevity is essential, and the entire experience takes on the atmosphere of a large party in a big house: conversations going on in different places and people drifting in and out of them, or even trying to

carry on several at the same time. Of course, IRC suffers from some of Usenet's problems as well—harassment, flaming, stupidity, addiction, people who won't shut up, and all the rest—but if you're awake in the middle of the night and want some conversation, an IRC channel is your answer.

What's it actually like to chat? Basically, you spend your time in one or more windows, each representing a different channel or user. The window is split into two panes: the viewing area and the composing area. You read the incoming messages in the viewing area, and you type your own messages in the composing area. Unlike Talk, in which you can watch people type character-by-character, IRC isn't *quite* real-time. What you type doesn't appear until you press the Enter key or click the Send button, so you have a chance to edit what you'll send. In practice, however, users dash off a comment, question, or reply, then send it quickly for the sake of staying with the conversation.

IRC takes some getting used to, simply because messages appear in the channel's window in the order in which the server turns them around. If you ask a question—say, "Did anyone catch the Top Ten list on Letterman last night?"—it's entirely possible that 20

You can change your nickname at any time with the `/NICK` command.

WHAT YOU NEED TO PARTICIPATE

If you want to engage in Chat, you need an IRC client. Aside from the Microsoft and Netscape offerings mentioned above, you have your pick of good ones. The Windows95.com, TUCOWS, and ZDNet sites offer several for download, and whether you're a Windows 3.x, Windows 95, or Windows NT user, you'll be well served. The most cited IRC clients for Windows appear to be mIRC (www.mirc.co.uk) and PIRCH (www.bcpl.lib.md.us/~frappa/pirch.html), which is shown in Figure 1.

When you start your IRC client, your first task is to select a Chat server to which to connect. If you're using mIRC or one of several other Windows clients, a list of servers will be included. Try any one of them. Once your client reaches the server, you'll be asked what channel, or topic area, you're interested in joining. As soon as you select one, you can start typing. The people on that channel will be told that you've arrived, and everything you say at this stage will be broadcast to all other users on the channel.

By typing `/HELP` (all IRC commands begin with the forward-slash character), or by explor-

tion. But the basis of IRC is public chat, so we'll stick with the universal access model.

As mentioned, Chat servers are available for machines running IIS 3.0. Also available for NT servers is the advanced server ConferenceRoom, from Webmaster (www.webmaster.com). IChat offers its own server, called ROOMS, but it's expensive—\$995, compared with \$99 to \$249 for ConferenceRoom. IChat's greatest selling point is a Netscape plug-in that lets you conduct Chat sessions directly in the browser, but you can do so only through the ROOMS server. All three servers support standard IRC clients.

HOW IRC WORKS

IRC users meet in channels. The "official" definition of a channel, according to the technical description of the IRC protocol in RFC 1459, is "a named group of one or more clients which will all receive messages addressed to that channel." The definition says nothing about the content of the shared messages, but by convention, messages on a given channel are confined to one topic area. When you connect your IRC client to a server, you can see what channels are available by typing `/LIST`. Once you find one in which you'd like to participate—let's say the `#NEWBIES` channel for this example (by convention, channel names begin with the pound sign)—you simply type `/JOIN #NEWBIES`.

Windows-based client software will, at this point, open a new window, showing who is currently on the `#NEWBIES` channel. You can then begin communicating. If the `#NEWBIES` channel does not currently exist, the `/JOIN #NEWBIES` command will create it, and it will be accessible to anyone using the `/LIST` command (although the IRC protocol does allow new channels to be set as private, secret, or invite-only).

If you create a channel, you're given the status of *channel operator*, or *op* or *chop*. Your nickname is prefaced by the `@` character (for instance, `@Xena`), and as channel owner you have special powers over that channel. If it's an invite-only channel, you can invite users to join you. You can also change the description of the channel's topic, and you can kick a user out. If you want a customized channel, you can alter the channel's *mode*: You can moderate the channel; specify that it's secret, private, or invite-only; limit the number of users; establish password-only access; and put together a ban filter to keep undesirables out. Obviously, this is significant power, and too many channel operators abuse it. But with thousands of IRC channels from which to choose, the easiest way to deal with power-mad channel ops is simply to go somewhere else.

When you connect to a server, it identifies itself and sends your IRC clients the message of the day (MOTD), usually a small welcoming message supplied by the server administrator. It then gives you a count of the num-

CHAT-SERVER TECHNOLOGY

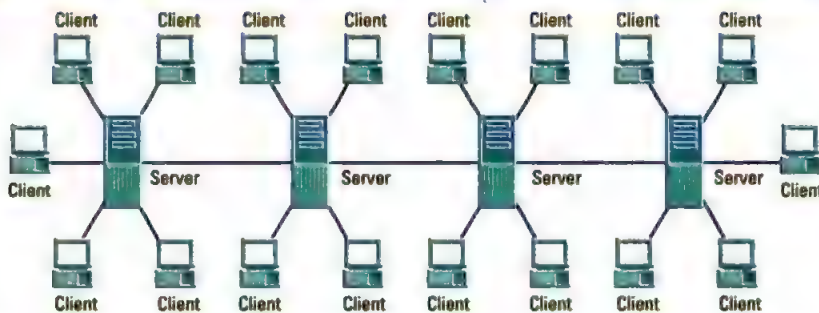


FIGURE 2: Chat servers are connected linearly, so some of the clients are connected only indirectly. Because of the way chat servers are connected, chatters on different servers can be separated in a netsplit, where two servers lose contact.

or more messages will fly by before a response to yours appears in the viewing window. It's as if you were trying to carry on a conversation with someone at the other end of a large and boisterous family dinner table and you had lost the ability to tune out other conversations. You hear everything, all the time. Hence the need for individual messaging—and the creation of new channels.

Just as interesting is that users don't usually go by their real names. When you connect to a server, you're asked to provide a *nickname*, and you can call yourself whatever you want. There can be any number of people going by the name John or Roboto or Xena or whatever (although some IRC networks allow you to "own" a specific nickname), and things can quickly get confusing.

ing your client's menus, you can perform a number of additional tasks. You can start directing comments to specific users, for example, thus beginning a side conversation, or you can query the Chat server for information about a user. You can invite users to join a channel, and you can even create your own channel. Some IRC clients let you bypass the IRC server and engage directly with a particular user, and some even let you grant access to your files (this one requires caution, of course!).

If you want to host a Chat service, you'll need a server, and as with a Web server, the machine must have a dedicated IP address. Ideally, the machine should be available 24 hours a day, 7 days a week, because IRC never quits. It's possible to offer a private Chat service, which could be useful in your organiza-

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ber of users currently connected to the server, as well as the number of IRC servers on the network visible to that server. At this point, the server sends a message to all servers on the network stating your nickname and the fact that you've connected. When you send a message, the server decides what to do with it. If you're the only person in a channel, the message goes to the server and nowhere else. If you send a message to a specific user, it will go to the server and the server will route it to the user either directly or through an IRC network (see below). If the message is a general one for the entire channel, the server sends it directly to clients connected to that server, and indirectly to everyone else currently in that channel by relaying it through other servers.

IRC NETWORKS

IRC is impressive enough on a standalone server, but its magic lies in the fact that IRC servers can be linked together into IRC networks, with each public channel accessible to any user connected to any server on that network. In other words, if you create a channel called #OFFICE97 to carry on discussions about using the software suite, any client on the server network can see the channel by using the /LIST command and can participate through the /JOIN command. All servers

simultaneously keep track of which users are on the network, which channels are available, and which client is connected to which server. Two connected servers can make up an IRC network, but the large IRC networks—EFNet, DALNet, and the Undernet—connect as many as 100 servers at once, with user populations numbering in the thousands.

Several lists of networks are available on the Web, among which is Saint's List at *home.sprynet.com/sprynet/saint*. Smaller networks abound: AnotherNet offers a kids-friendly chat environment; StarLink IRC and IceNet stay clear of pornography and other offensive topics, as does the up-and-coming SuperChat. Kidlink and LinuxNet make their subject matter clear (and they work to keep it that way), and there's even ScoutLink for anyone in the scouting movement. Chat networks specific to particular geographic regions are becoming increasingly popular as well, as evidenced by the growth of Australia's OzOrg.

Since IRC servers are connected in a linear fashion (see Figure 2), they behave differently than the Internet itself. Unlike a Web transaction, in which data packets are rerouted whenever one node becomes unavailable, IRC networks experience frequent broken connections between servers, usually when network traffic becomes heavy. When the connection between two servers is lost, the

network splits in what is called, unsurprisingly, a *netsplit*. In a 10-server network, for example, if server 7 loses its connection with server 8, the result will be a 7-server network and a 3-server network, and these can split even further. The servers will continually attempt to reconnect, however, and once they succeed, users will once again be able to chat.

If you're in a busy channel, you can tell if a split has occurred: Suddenly you'll see a message saying a large number of people have left the channel. They *could* have all opted out simultaneously, but the more likely explanation is a netsplit. If you want to keep chatting with these people, the best thing to do is to wait until the servers reconnect, for one very good reason. If you disconnect from your current server and join the same channel from another server, when the IRC network reconnects you might experience a *nick collision kill*. Essentially, this means that your nickname is present on two different servers, and upon seeing this, the servers will, in IRC terms, *kill* it on both of them. If you're in the middle of an enthralling conversation, that can be more than a little annoying. □

Neil Randall is the author of The Soul of the Internet (International Thomson Computer Publishing) and coauthor of Special Edition Using Microsoft FrontPage 97 (Que).

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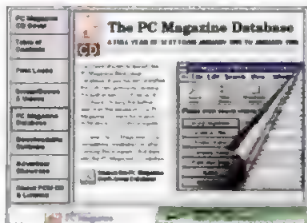
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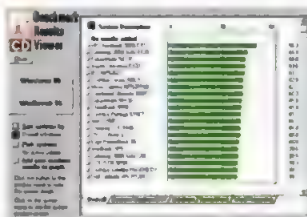
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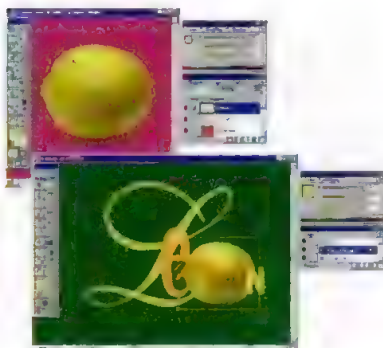
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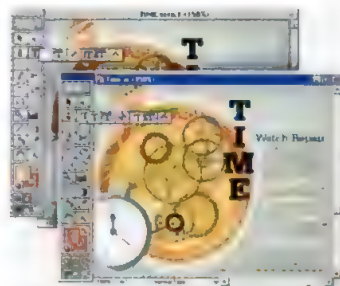
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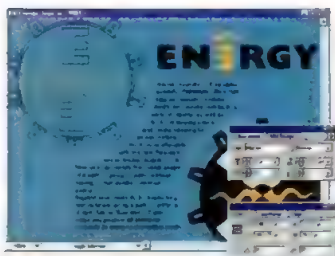
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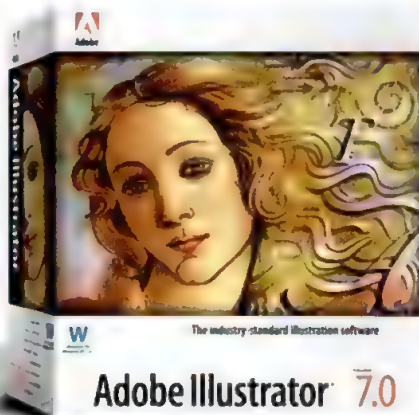
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PC Tech/Tutor

By Jeff Prosis

Internet Acronyms

Catch up on the jargon being used by Internet gurus.

Confused by the latest spate of Internet-related acronyms flooding the computer industry? You're not alone. There are so many unexplained acronyms that understanding them is like trying to communicate in a foreign country when you don't know the language and have forgotten your translator.

To help you feel more at home, here is a concise explanation of some common Internet acronyms from ADSL to WWW. Don't be caught off guard the next time an Internet guru throws the latest jargon at you. Instead, be prepared. Learn the language ahead of time so you don't feel out of place when terms such as ICMP and PPTP are being thrown around.

ADSL (Asymmetric Digital Subscriber Line) A digital phone-line technology that supports high-speed connections to the Internet using ordinary copper telephone wires. Proffered by AT&T as an ISDN replacement for Web surfers, ADSL is "asymmetric" because uplink speeds (64 Kbps) differ markedly from downlink speeds (up to 6 Mbps). ADSL is currently available only in selected markets.

ARP (Address Resolution Protocol) The protocol that translates Internet Protocol, or IP, addresses (for example, 128.10.3.42) into physical network addresses. One of the many members of the TCP/IP protocol suite, ARP is a key player in the process that allows a packet of data addressed to a particular Internet host to find its destination. See also *DNS*, *RARP*, and *TCP/IP*.

CGI (Common Gateway Interface) A means for transferring information that users have typed into forms found on Web pages to scripts or programs run on a Web server, and vice versa. Two of the most common uses for CGI are performing database queries in response to user input and creating dynamic Web pages by assembling HTML data on the fly. The most popular language for writing CGI programs is Perl.

DNS (Domain Name Service) The online database that correlates Internet IP addresses (for example, 128.10.3.42) to human-readable domain names such as *pcmag.com*. The database isn't stored on any one computer; rather, it's distributed among thousands of *name servers* spread throughout the Internet.

FAQ (Frequently Asked Questions) A document with answers to—you guessed it—frequently asked questions. FAQs are widely available online and cover a broad spectrum of topics ranging from gourmet cooking to the inner workings of TCP/IP.

FTP (File Transfer Protocol) A widely used TCP/IP protocol for transferring files from one machine to another. Internet users may use FTP applications to log in to FTP servers and download files. No restrictions are placed on file contents; they may contain text or binary data. Files may be protected from unauthorized access using authentication control, or

ICMP (Internet Control Message Protocol) The TCP/IP protocol used to send control and error information regarding IP datagram transmissions. When an IP datagram cannot be delivered to its destination, perhaps because the machine at the destination is temporarily out of service or message traffic is too heavy, a router may use ICMP to notify the sender of the failure. See also *IP*.

IGMP (Internet Group Management Protocol) The TCP/IP protocol that permits Internet hosts to take part in *IP multicasting*—an efficient means of broadcasting messages to groups of computers.



they can be made public with *anonymous FTP*, which doesn't require a login name or password. See also *TFTP*.

HTML (Hypertext Markup Language) A text-based page description language that uses tags to describe formatting idioms and allows richly formatted documents to be created using everyday text editors. HTML is the language used to create Web pages. See also *HTTP* and *VRML*.

HTTP (Hypertext Transfer Protocol) The text-based protocol that serves as the official language of the World Wide Web. HTTP defines high-level commands, or *methods*—such as GET and PUT—that browsers use to communicate with Web servers. The GET command requests a page of HTML data, a .GIF file, or other resource from a Web server in preparation for displaying it in a browser window. See also *HTML*.

InterNIC (Internet Network Information Center) The administrative organization that is responsible for, among other things, allocating domain names and distributing RFCs. Funded by the National Science Foundation (NSF), the InterNIC is currently run by Network Solutions and AT&T. See also *RFC*.

IP (Internet Protocol) The protocol responsible for transmitting packets of data over the Internet and routing them to their destinations. Tagging a packet with an IP address identifying an Internet host and transmitting it using IP is analogous to addressing an envelope and dropping it in the mail. IP plays the role of post office, allowing the networks and routers involved in the delivery process to talk to each other as the packet finds its way to the addressee. See also *TCP*, *TCP/IP*, and *UDP*.

ISDN (Integrated Services Digital Network) A digital telephone network that transmits data

in digital form (1's and 0's) rather than analog form. Provided it's available in your area, ISDN is a quick and convenient way to access the Internet from your home or small office at speeds of up to 128 Kbps.

ISP (Internet Service Provider) A company, usually a local one, that provides connections to the Internet for a monthly or hourly fee.

MIME (Multipurpose Internet Mail Extensions) A protocol for sending non-ASCII data—for example, sound, video, and graphics—over the Internet using text-based transport protocols such as SMTP. See also *POP* and *SMTP*.

NNTP (Network News Transfer Protocol) The protocol used to transmit Usenet messages across the Internet.

PING (Packet Internet Groper) A TCP/IP application used to determine whether other machines are online and available. Pinging is performed by sending an ICMP echo request and waiting for a reply. See also *ICMP*.

POP (Post Office Protocol) The text-based protocol used to send and retrieve Internet e-mail messages. Unlike SMTP, which is used primarily to transfer mail messages between mail servers, POP provides a way for mail programs to interact with the virtual mailboxes in which messages wait until they are sent or retrieved. POP comes in two flavors: POP2 and POP3. The two are related in name only and are not compatible. See also *SMTP*.

PPP (Point-to-Point Protocol) The most popular protocol for establishing dial-up connections to the Internet. PPP is similar to but more robust than SLIP, which lacks support for data compression, error detection, and multiple protocols on a single line. PPP resolves all these deficiencies and more. See also *PPTP* and *SLIP*.

PPTP (Point-to-Point Tunneling Protocol) An enhanced form of PPP that uses "tunneling"—encapsulating packets of data written for one network protocol inside packets used by another—to allow TCP/IP data to be transmitted over non-TCP/IP networks. The most common use for PPTP is to join physical networks together to form "virtual internets" using the Internet as a go-between. See also *PPP*.

RARP (Reverse Address Resolution Protocol) The Internet protocol that permits a physical network address (for example, a 48-bit Ethernet address) to be translated into an IP address by sending a request to an RARP server. This protocol is used by diskless workstations to determine their own IP addresses at start-up. See also *ARP*.

RFC (Request for Comments) An online document containing proposals, standards, and other information regarding Internet technologies. RFCs are available by anonymous FTP from a variety of locations, including InterNIC's own *ds.internic.net*. They may also

be requested by e-mail (*mailserv@ds.internic.com*) or by phone (800-444-4345).

SLIP (Serial Line Internet Protocol) A widely used but somewhat outdated protocol for establishing dial-up connections to the Internet. Technically speaking, SLIP is a packet-framing protocol that defines how IP datagrams (packets of data transmitted over the Internet using IP) are packaged for transmission over serial data lines—for example, over a serial link between your modem and an Internet service provider. See also *IP*, *PPP*, and *PPTP*.

SMTP (Simple Mail Transfer Protocol) The text-based TCP/IP protocol used to exchange mail messages on the Internet. A simplified version of the earlier MTP (Mail Transport Protocol), SMTP defines the format and content of transactions between mail servers. See also *MIME* and *POP*.



T1 A leased line that provides high-speed 1.544-Mbps (megabit per second) connections to the Internet. Typically available in large-company and university settings. Also known as "Web Surfer's Heaven."

T3 A leased line that provides ultra-high-speed 45-Mbps connections to the Internet.

TCP (Transmission Control Protocol) The TCP/IP protocol that provides reliable stream delivery service to Internet applications. Using TCP, an Internet client can open a virtual connection to another Internet client and transmit streams of data. Unlike its counterpart, UDP, the TCP protocol ensures reliable delivery by retransmitting lost and corrupted data packets. It also guarantees that an application on the receiving end of a TCP connection will receive bits and bytes in the same order in which they were sent. See also *UDP*.

TCP/IP (Transmission Control Protocol/Internet Protocol) A suite of networking protocols that includes TCP, IP, UDP, ARP, RARP, and ICMP,

to name just a few. Often referred to as the "the glue that binds the Internet," TCP/IP allows disjoint, dissimilar, and spatially separated physical networks to be joined together to form one large virtual network, or "internet." For more detailed discussion of TCP/IP, see the Tutor column "A Beginner's Guide to TCP/IP" in the November 19, 1996, issue of *PC Magazine*.

TFTP (Trivial File Transfer Protocol) A simplified version of FTP that lacks the authentication services FTP provides and relies on UDP rather than TCP for data transport. TFTP is less complex and easier to program than FTP. See also *FTP*.

UDP (User Datagram Protocol) The TCP/IP protocol that allows packets of data, or datagrams, to be sent from one Internet application to another. UDP is a "connectionless" protocol, because, unlike TCP, it does not require the sender and receiver to establish a connection before data is transmitted. It's considered "unreliable," because it doesn't guarantee that datagrams will arrive in the same order they were sent, or even that they will arrive at all. If reliability is desired, it's up to the application using UDP to provide it. See also *TCP*.

URL (Uniform Resource Locator) A human-readable string that identifies the location of a resource on the Internet (for example, a page of HTML data or a .GIF file) and the protocol used to retrieve it. The URL for a document published by the World Wide Web Consortium that describes the format of URLs is <http://www.w3.org/pub/WWW/Addressing/Addressing.html>.

VRML (Virtual Reality Modeling Language) The 3-D counterpart to HTML. VRML is a scriptlike language that permits rich 3-D scenes to be described in simple text files and displayed in VRML-capable Web browsers. VRML solves the problem of the high bandwidth required to transmit bitmapped scenes by minimizing the flow of information from the Web server to the browser and allowing the browser to render the scene—and thus do the bulk of the work required to display the scene—locally. See also *HTML*.

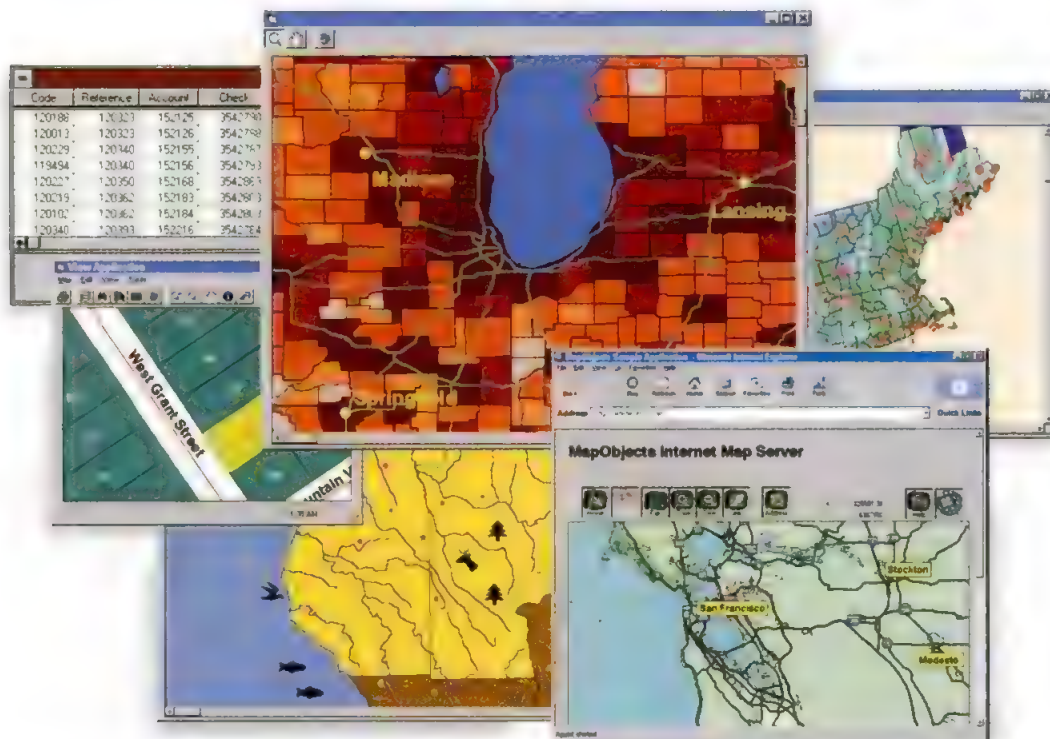
WWW (World Wide Web) A virtual world formed by Internet HTTP servers containing richly formatted pages that can be downloaded upon request to browsers such as Netscape Navigator and Microsoft Internet Explorer. It is more commonly known as "the Web." It was the creation of this network in 1994 (and the proliferation of browsers that followed soon after) that made Internet a household word. See also *HTML*, *HTTP*, and *VRML*. □

Jeff Proise is a contributing editor of *PC Magazine*.

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120013	120323	152126	35427888	35427888	293	245	BELLEVUE	0.00170	244
120029	120340	152155	35427871	35427871	1619	1601	CHELSEA	0.00117	1600
119494	120340	152156	35427930	35427930	157	101	CHANNING	0.00360	100
120027	120350	152168	35428632	35428632	1015	1001	CYPRESS	0.00073	1000
120019	120362	152183	35428035	35428035	1221	1213	FERN	0.00067	1214
120102	120362	152184	35428034	35428034	567	641	NOTTINGHAM	0.00113	640
120340	120393	152216	35427847	35427847	1649	1621	CHELSEA	0.00081	1620
							New	Apply	

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PC Tech/Power Programming

By Jeff Proise

Customizing MFC Applications

Three more ways to fine-tune your C++ programs for Windows 95.

In the last Power Programming column, we discussed three techniques that can make your MFC applications more professional in their operation and appearance. We showed how you can eliminate flashing window redraws and explored a couple of improvements to printing features. This time we give you three more techniques to help you tweak your applications. We show how to get your programs to remember the placement of toolbars, how to create your own control views, and how to create customized document views. Sample source and program code is available for you to download from PC Magazine Online (see the sidebar "Getting the Files," in the Utilities column).

PRESERVING TOOLBAR STATES

When I teach MFC programming classes, one of the questions I'm often asked is: "How do I preserve the state of my application's toolbars?" For example, a user goes to the View menu and chooses to make three toolbars visible. He docks one toolbar to the right side of a window, docks another to the top, and floats the third in the center in its own miniframe window. How to make certain that the toolbars assume the same configuration the next time the user starts the application?

The answer is surprisingly simple. MFC's `CFrameWnd` class includes a pair of member functions named `SaveBarState` and `LoadBarState`. Call `SaveBarState` from your main frame window's `OnClose` handler to record the toolbar states. Call `LoadBarState` from the window's `OnCreate` handler to restore the toolbars. Be sure to call `LoadBarState` after the toolbars are created, not before. As a bonus, the visibility state of your application's tool-

bars and status bars will be preserved, too. Both `SaveBarState` and `LoadBarState` can accept a string to identify a saved toolbar state. You can store multiple toolbar states by specifying different ID strings.

To make your code more robust, write a handler—`OnEndSession`—for `WM_ENDSESSION` messages and call `SaveBarState` from it if the `BOOL` parameter passed to `OnEndSession` is nonzero. That will ensure that the current toolbar state is recorded if

Windows is shut down while your application is running. Also, if you'd like MFC to record toolbar states in the Registry rather than in an .INI file, call `CWinApp::SetRegistryKey` from your application's `InitInstance` function.

YOUR OWN CONTROL VIEWS

Have you ever worked with `CEditView`, `CTreeView`, or other MFC control-view classes and found yourself wishing you could create new control views of your own? Good news:

In MFC 4.0 and higher, you can. Simply derive a class from MFC's `CCtrlView` and follow these steps.

1. Write a default constructor that calls `CCtrlView`'s constructor with two parameters: a `WNDCLASS` identifying the control type (for example, "SysTabControl32" for tab controls) and an ID value equal to `AFX_WS_DEFAULT_VIEW`.

2. Add an inline function—`GetXxxCtrl`—that returns a reference to the underlying control. The model here is `CTreeView::GetTreeCtrl`, which returns a reference to a `CTreeCtrl` so that `CTreeCtrl` member functions can be called on a `CTreeView`.

3. Optionally override the class's `PreCreateWindow` function and apply default control styles.

The right pane of Figure 1 shows a tabbed view derived from the Windows 95 tab control. The complete source code for a `CTabView` class, which can be used as the base class for such a view, is shown in Figure 2. It works by converting a Windows 95 or Windows NT tab control into a full-blown view.

If you'd like to do something when the user clicks one of the `CTabView`'s tabs (for example, bring a page of controls to the foreground), use MFC's mes-

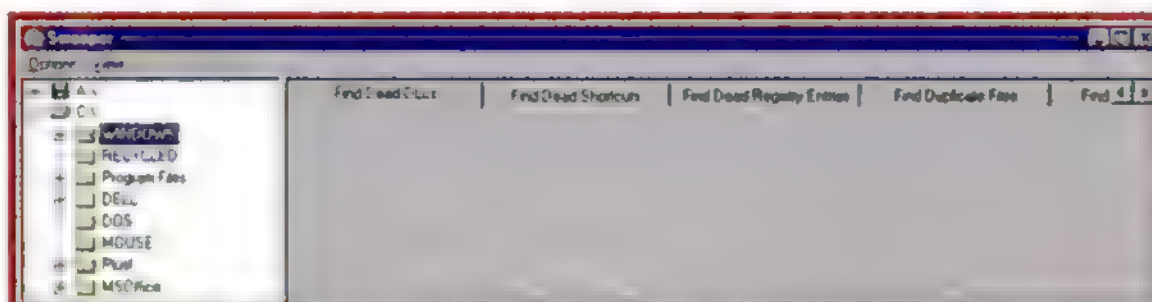


FIGURE 1: This tabbed view was derived from Windows 95's tab control.

```
// TabView.h
class CTabView : public CCtrlView
{
    DECLARE_DYNCREATE (CTabView)

public:
    CTabView () :
        CCtrlView ("SysTabControl32", AFX_WS_DEFAULT_VIEW) {}

    CTabCtrl& GetTabCtrl () const { return *(CTabCtrl*)
        this; }
    virtual BOOL PreCreateWindow (CREATESTRUCT&);
};

// TabView.cpp
IMPLEMENT_DYNCREATE (CTabView, CCtrlView)

BOOL CTabView::PreCreateWindow (CREATESTRUCT& cs)
{
    // Initialize the common controls library
    ::InitCommonControls ();

    // Give the base class a chance to initialize
    if (!CCtrlView::PreCreateWindow (cs))
        return FALSE;

    // Apply default control styles
    cs.style |= TCS_SINGLELINE | TCS_TABS;
    return TRUE;
}
```

FIGURE 2: This `CTabView` class produces the view in Figure 1.



sage reflection mechanism to reflect TCN_SELCHANGE notifications to your derived view class and write a handler for them.

TWEAKING THE DOC/VIEW MODEL

Roughly half of the MFC questions that I'm asked involve tweaking the document/view architecture. By "tweaking," I mean changing the way document/view applications behave. Typical questions are "How do I modify a frame window so that it assumes its last size and position when my application is started?" and "How do I write an MDI application that supports not only multiple views of a document but multiple view types?"

In almost every case, the answer comes by developing a thorough understanding of what goes on under the hood in MFC. There are no "magic bullets" that I'm aware of; to change the way a document/view application operates, you must understand how it operates. I've spent more time than I care to admit single-stepping through MFC's source code with a debugger to see what happens when a document/view application executes. Once you see which functions are called and when, you can pick your point of attack. In many cases, the key is to know which virtual functions or message handlers you need to override in a derived document, view, or frame window class.

Here's a case in point. The MultiView

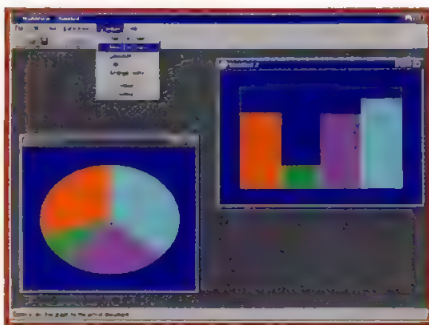


FIGURE 3: This MDI application supports multiple view types.

application shown in Figure 3 is a standard MDI document/view application in every way but one. When the user goes to the Window menu to display a new view of an open document, he or she can choose the view type. A view created with the New Pie Chart command draws a pie chart of the four quarterly revenues entered through the Edit/Revenues command. If New Bar Graph is chosen instead, a bar graph is drawn. Views that draw pie charts are created from the application's CPieView class, while views that draw bar graphs are created from CBarView. That's significant because a conventional document/view application supports just one view type for each document type. So how does this program support two?

You can see for yourself by downloading the source code from PC Magazine Online or from ZDNet on CompuServe (GO ZNT:Tips). One note: When you unzip MultiView's source code, use PKUNZIP's -d option to preserve the directory structure stored in the .ZIP file. Also, because PKZIP doesn't understand long filenames, you'll have to rename all files named MV.* as MultiView.*.

Look inside the application class's InitInstance function and you'll see that it creates two document templates, one for CPieViews and another for CBarViews. The CPieView document template is registered in the normal manner by passing its address to AddDocTemplate. The other isn't registered anywhere; instead, its address is simply stored away in a member variable named m_pOtherDocTemplate.

Selecting New Pie Chart from the Window menu executes MFC's default Window/New command handler, which creates a new frame window and view using the information stored in the default document template. Selecting New Bar Graph executes CMainFrame::OnNewBarGraph, reproduced in Figure 4, instead. OnNewBarGraph retrieves the document template pointer stored in m_pOtherDocTemplate and creates a new view the same way the framework does: by calling the document template's CreateNewFrame and Initial-

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```
void CMainFrame::OnNewBarGraph()  
{  
    CMDIChildWnd* pActiveChild = MDIGetActive ();  
    CDocument* pDocument;  
  
    // Get the active document.  
    if ((pActiveChild == NULL) ||  
        ((pDocument = pActiveChild->GetActiveDocument ()) == NULL)) {  
        AfxMessageBox (AFX_IDP_COMMAND_FAILURE);  
        return;  
    }  
  
    // Retrieve the bar graph document template.  
    CMultiDocTemplate* pTemplate =  
        ((CMyApp*) AfxGetApp ())->m_pOtherDocTemplate;  
  
    // Create a new document frame containing a CBarView.  
    CFrameWnd* pFrame =  
        pTemplate->CreateNewFrame (pDocument, pActiveChild);  
    if (pFrame == NULL) {  
        TRACE0 ("Warning: failed to create new frame.\n");  
        return;  
    }  
  
    pTemplate->InitialUpdateFrame (pFrame, pDocument);  
}
```



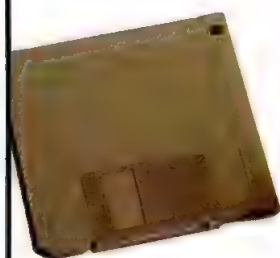
FIGURE 4: This command handler, which is patterned after MFC's default Window/New command handler, creates a new view of a document from a document template that has not been registered with the framework.

UpdateFrame functions. Because this document template uses CBarView instead of a CPieView, the resulting view shows a bar graph instead of a pie chart.

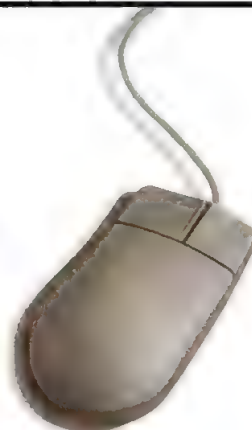
The key to writing an application like Multi-View is knowing how and when MFC creates new views of an open document. I examined the MFC source code and found the default handler for the Window/New command. Once I understood how it worked, I wrote the handler in Figure 4 and wired it into the application. I got lucky. Creating a new frame window and view from an unregistered document template doesn't seem to bother MFC one bit. It's not always that easy, however. MFC does a lot of work on an application's behalf, and in order to do that work, it must make certain assumptions about how the application operates. Sometimes a seemingly simple change, such as this one, will break the framework and force you to write more code to patch things up.

A word of advice: If you find yourself writing hundreds of lines of code to effect a simple change to the document/view architecture, stop and ask yourself if there's a better way to approach the problem. There are usually multiple ways to go about it, and a sound plan of attack beats brute force any day. □

Jeff Prosise is a contributing editor of PC Magazine.



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PC Tech/Utilities

By John McSorley

Be Paged by Your E-Mail

MailPage monitors MAPI clients for incoming faxes and e-mail.

Have you ever been out of the office for the day and missed an important e-mail message? Do you occasionally work at home and dial into the office to retrieve e-mail (often just to find out you didn't receive any)? This issue's utility, MailPage, was designed with both scenarios in mind. If you have a modem, a pager, and a MAPI-based e-mail system such as Microsoft Mail or Microsoft Exchange, you may never face either situation again. MailPage monitors your in-box for new messages, and when it finds one, it pages you. If you have an alpha-style pager, the program will spell out the sender's name and message subject. If you have a numeric-style pager, it will send an encoded message representing the sender and a keyword within the subject line using keyword lists you've previously defined. If you are using Microsoft Exchange to receive faxes, MailPage can notify you of incoming faxes as well.

MailPage is a 32-bit program that runs under Windows 95 or Windows NT 3.51 or later. You can obtain MailPage by downloading it from PC Magazine Online or by mail. (Refer to the sidebar "Getting the Files" for details.) The source code for MailPage, which was written in Microsoft Visual Basic 4.0, is also provided for those interested in seeing how it works.

USING MAILPAGE

To install MailPage, unzip the setup files into a temporary directory and run the program Setup.exe. Setup will offer you a default installation directory, which you can change if you'd prefer another. When the installation is complete, you can delete the setup files and launch MailPage. The program lists your unread mail messages in the main window (see Figure 1) and displays three indicators on the status bar:

- Online/Offline (whether you are currently connected to your mail system),
- Inactive/Active (whether paging is enabled), and
- Unread (number of unread messages).

To configure MailPage for operation, choose Properties from the File menu. This will bring up the tabbed dialog box shown in Figure 2. The first tab lets you set pager parameters. In the Pager control group at the top of the page, indicate whether you have an alpha- or numeric-style pager, and what communications port the modem is attached to (for example, COM1). This is also where you

If you select the numeric pager option, the Numeric Pager Settings control group will appear in the lower portion of the page. An edit box lets you enter the telephone dialing string for your pager service, for example,

1-313-555-1111....

The commas tell a Hayes-compatible modem to wait a few seconds before proceeding with the rest of the dialing. If your pager service has a PIN, you might enter a string like this:

1-800-555-1111....123456#....

This dials the telephone number, pauses, enters the PIN (123456) followed by a pound sign, and pauses again. In the case of MailPage, what follows will be the digits that represent the message to be sent to the pager.

The From and Subjects lists help MailPage encode a numeric message to send to your pager. The From list can contain the last names of up to 99 senders whom you wish to include in the numeric message. The Subjects list can contain up to 99 words that you wish to include in the numeric message as part of the subject. These words should be entered in descending order of importance. That's because MailPage scans the list from the top and sends the first match with the message subject that it finds. You can use drag-and-drop to reorder your list if necessary. Click the Print Lists button to print out the From and Subjects lists, so you can keep them with you to decode your pages.

Messages sent by MailPage to a numeric-style pager have the following format:

999-NNN-XXYY

The "999" in place of an area code distin-

IN THIS ISSUE

MailPage

MailPage monitors your MAPI-compliant in-box and notifies you via pager of unread e-mail or faxes. For each new message, it transmits the sender's name and the subject of the message.



select which pager object to use. The one included with MailPage is called Paging.Pager, and unless you're a programmer, it's the only one you'll ever need. (Programmers take note: You can call on the OLE Automation pager object to page a person, for example, when a button in a Microsoft Access program is clicked. An example demonstrating this technique is included with the program files.)

FOR PROGRAMMERS ONLY MailPage consists of an interface program and two OLE Automation servers. It was written with Microsoft Visual Basic 4.0. The full source code for MailPage, available on PC Magazine Online, demonstrates these programming techniques:

- how to create an OLE Automation server and an interface that calls it using Visual Basic 4.0, and
- how to build a reusable procedure to load data for a form's controls from the Windows Registry.

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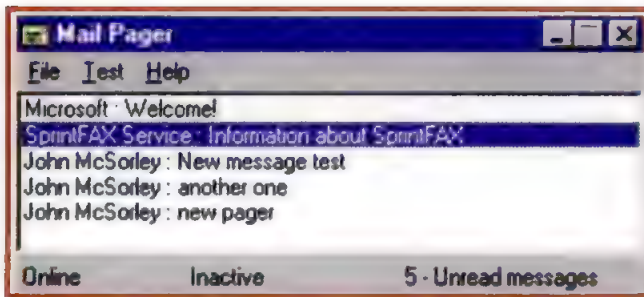


FIGURE 1: The Main screen displays the number of unread messages and the current application status.

guishes e-mail or fax paging from standard telephone number paging. The number transmitted in place of the exchange (NNN) is the number of unread messages in your in-box. The XX portion of the number is a code for a person on your From list. It is set to 00 if the sender does not match a name on the list. The YY portion of the number is a code for the subject word match, using the list you set up. This is also set to 00 if there is no match.

Under the configuration shown in Figure 2, if I had no previous e-mail in my in-box and got a message from "John Jones" with a subject "Bid requirements: critical information enclosed," MailPage would send the following message:

999-001-0103

If you select an alpha-style pager, the bottom portion of the Pager Settings tab will contain a control group for Alpha Pager Settings (see Figure 3). The message sent

the sender's last name and up to 65 characters of the message's subject. I limited the total to 80 characters because some pagers cannot handle more than that, but 80 characters should be enough for most messages.

The second tab in the Properties dialog box is for Mail Settings. Here you choose the mail object (mail-monitoring server). MailPage includes just one mail object, called MPMAPIServ.MPMAPI. It supports MAPI-compliant e-mail programs, such as Microsoft Exchange and Microsoft Mail. Those programs ignore the Login Name and Password settings, which may, however, be necessary for some other e-mail programs. MailPage's open architecture allows programmers to write mail objects for use with other mail systems—Lotus cc:Mail, for example, which uses the VIM protocol. But if you're not a programmer, you'll never need to change this.

The check box at the bottom of the Mail Settings group of controls lets you choose whether to have MailPage ignore unread mail messages at start-up. If you check this option, MailPage will not page you for unread messages in your in-box when you launch the program.

The third tab in the Properties dialog box lets you control Operating Times—when MailPage will page you (see Figure 4). This feature lets you prevent MailPage from paging you in the middle of the night, for example. The day is divided into 1-hour time slots. To change a time slot's status, highlight the cell you want to change and click the Active or Inactive button. You can select more than one time slot at a time, using the mouse or the keyboard. For keyboard operation, use the arrow keys and the shift key to highlight a block in the grid, and then use the accelerator keys for the Active and Inactive buttons. In the example shown in Figure 4, MailPage will page you starting at 6:00 A.M. on weekdays.

After setting the MailPage Properties, you can check your settings by selecting Test | Pager from the main menu. If you are using a numeric pager, MailPage will try to send you the message "999-000-1122"; if you are using an alpha pager, it will try to send you the message "TEST." If the test pages do not come through properly, return to the Properties dialog box and make sure the commu-

nications port, telephone number, and other settings are correct.

Now that you have configured and tested MailPage, you are ready to begin using it. When you leave the office for the day, leave your computer and modem powered on and start MailPage. MailPage will monitor your in-box and page you when you receive new e-mail messages. If you are using a modem to receive e-mail rather than a network, be sure to configure your system to hang up after retrieving your e-mail, so the modem can be used to page you.

INSIDE MAILPAGE

MailPage consists of one main Visual Basic program and two OLE Automation servers, also written in Visual Basic. One server mon-

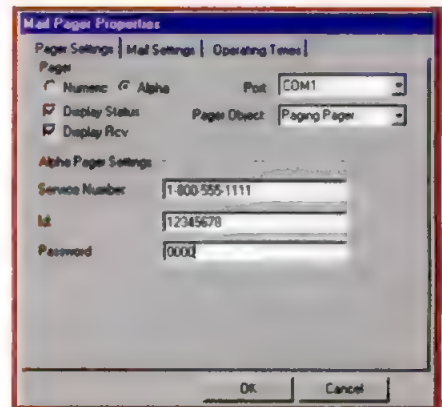


FIGURE 3: This screen allows you to change the pager settings for an alpha-style pager.

itors incoming e-mail messages; the other handles interaction with the pager. I wrote the pager as an OLE Automation server instead of embedding it in the main program so that it could be accessed from within programs, such as Access, whose macro languages support OLE Automation.

The mail-monitoring server was created separately so that programmers could more easily integrate additional mail-monitoring servers. I could not support every existing e-mail program in MailPage; there are too many of them. But because I used a separate OLE Automation server for mail monitoring, anyone with the source code can add other mail systems without modifying the main program, Mailpage.exe.

To keep things simple, the mail object OLE server does not implement all the functions of the MAPI mail system. For example, it does not send mail or display the address book. It just implements what it needs to monitor new messages and retrieve a few key components. To add support for another mail system (for example, cc:Mail) you would have to write an OLE Automation server that implements the five functions shown in Figure 5.

Visual Basic 4.0 makes it easy to create OLE Automation servers. The hardest part is

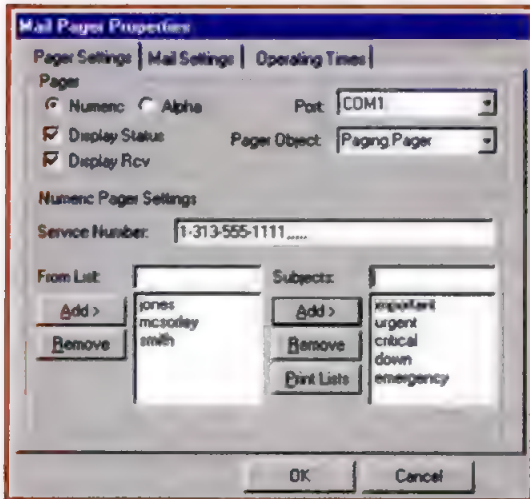


FIGURE 2: This screen allows you to change the pager settings for a numeric-style pager.

to an alpha-style pager by MailPage has a simple format:

From : Subject

MailPage will send the first 15 characters of

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deciding how to organize the functions you need into different objects. In MailPage, the pager and mail-monitoring system were logical choices, since splitting them off makes the program more easily extensible. Once you've made these decisions, the actual creation of the server is just a matter of creating a new VB project with the new class implementing the functions and data necessary to accomplish your goal. Setting the properties of the class to public exposes it to other programs that implement OLE Automation.

Since OLE requires numerous Registry entries, I used the Setup Wizard included with Visual Basic 4.0 to install the application and register MailPage's OLE servers. MailPage was created with the Professional Edition of Visual Basic 4.0. With the Enterprise Edition,

Another useful new feature of Visual Basic 4.0 is the ability to create your own collection classes—a feature used by MailPage to store its property settings. Collections are similar to arrays, but where an array's elements must all have the same data type, a collection can store elements of different types. Items in a collection can be retrieved either by index, as with arrays, or by a key string. MailPage initializes the collection with items whose key strings identify them. (The key strings in this case are the properties themselves.) It then fills in the item values from the Registry, where the values are stored using the same key strings. The Tag property of each control on the Property form matches one of the key strings, and MailPage uses this association to set and get the values displayed by these controls. Note that MailPage doesn't need separate code to handle the storing and retrieving of data from the Registry, since it uses the functions GetSettings and SaveSettings.

MailPage's FillForm routine could have been written more simply, but I wrote it in a more general way so that the code would be reusable. You can reuse the collection class in other applications that populate and retrieve values from forms. FillForm loops through the form's control collection looking for controls that have a nonblank Tag property. The Tag property is used as a key to retrieve a value from the Properties collection, and the control is initialized with that value in a way that's dependent on the control's type. That, in fact, is the reason for using FillForm rather than the more direct approach of initializing each control from the corresponding Registry value.

The procedure for retrieving the values from a form's controls is similar. When the user clicks the OK button, MailPage calls

UnloadForm before actually unloading the form. UnloadForm steps through the list of controls seeking keys that have a nonblank Tag property. For each such control, it transfers the control's data to the collection item whose key matches the Tag. Here again the exact technique for transferring the data depends on the type of control. After the collection

MAIL-SYSTEM FUNCTIONS

Function	Purpose
Logon(username, password)	Logs user on to the mail system.
Logoff()	Logs user off the mail system.
Check4NewMail()	Looks for new mail and populates the mail message collection.
Count()	Returns the number of unread mail messages in user's in-box.
Item(index)	Returns a mail message from the collection based on key or index.

FIGURE 5: To create a new mail-monitoring server, you need to implement these functions.

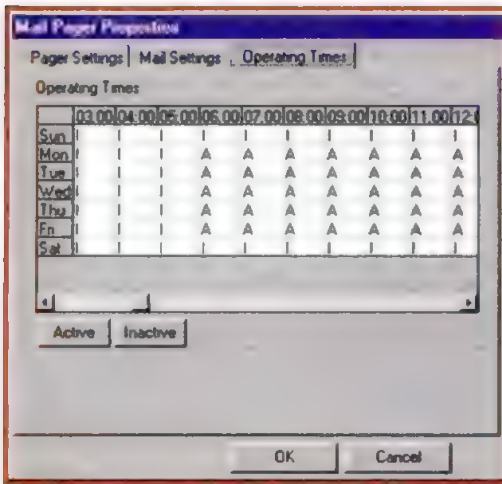


FIGURE 4: You can tell MailPage when it's okay to page you and when to leave you alone.

you can create remote OLE Automation servers: Your paging server object could be located on a network server computer, and users would not need to have modems connected to their PCs in order to be paged.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

User-to-User

By Neil J. Rubenking

Keeping Your Temp Directory Clear

Your advice about automatically deleting the contents of the Temp directory each time the system starts up could cause data loss for some users. Microsoft Word (versions 6 and 7 at least) stores its timed AutoSave files in the Temp directory by default. Deleting the contents of Temp automatically from within Autoexec.bat thus defeats the purpose of AutoSave. One user on my network had worked on a document for about 4 hours, relying on AutoSave, when the power went out. The AutoSave files were deleted, and I was in the doghouse.

You can see this for yourself. Restart the system in DOS mode and delete all files in the Temp directory, then type WIN to start Windows. Open an Explorer window to the Temp directory. Launch Word and load any document, then set the AutoSave time to 1 minute. After a minute, you will see an .ASD file appear in the Temp directory. If this file is deleted, Word won't be able to recover the file in case of a system crash.

I attacked this problem in two different ways. On my home PC, I use a shareware utility that can distinguish the age of files. I configured it to delete files from the Temp directory only if they are over three days old. On my office network, I configured all the PCs to delete files only if they don't look like Word AutoSave files (.ASD). If Autoexec.bat detects a possible Word temporary file, it warns the user to run Word immediately, which automatically restores the document.

I did notice that in Word under Tools | Options | File Locations, you can specify a directory for AutoSave files. If this is blank, as mine was, the default seems to be the Windows Temp directory.

JACK MACDONALD
Vancouver, B.C., Canada

PC MAGAZINE: In a perfect world, the Temp directory would never contain any files that need to survive a system restart, and it would never contain any files that are no longer useful. As Mr. MacDonald points out, however, a system crash can leave important files in the Temp directory along with unwanted detritus.

As noted, in the case of Word you can force the essential AutoSave files to be stored elsewhere. But there may well be other programs that store files in the Temp directory that should not be deleted after a system crash. What we need is a way to empty the Temp directory only when the system has been shut down normally. It would be convenient if Windows 95 could automatically set some kind of signal upon normal shutdown; absence of this signal would be the cue to skip clearing the Temp directory. But Windows 95 doesn't lend itself to performing specific activities at shutdown, so we'll rely on the user. Append the following lines to the end of your AUTOEXEC.BAT (if the last line of your AUTOEXEC.BAT is "WIN", insert these lines before it).

```
ECHO If restarting after a system
ECHO crash.
ECHO DON'T clear the TEMP directory.
CHOICE /T:Y,10 Clear the TEMP
directory
IF ERRORLEVEL 2 GOTO NoClear
ECHO Y | DEL C:\TEMP\*.*
:NoClear
```

Now during the start-up process, the system will ask if it should clear the Temp directory. If you don't answer in 10 seconds, it will assume Y for yes. Thus, for a normal start-up, you don't have to do a thing. But if the system crashes, you can wait for this question during the reboot process and enter N for no. You can also change the CHOICE command's first command line switch to /T:N,10. That makes no the default answer; the Temp directory will be cleared only if you watch for this question at start-up and answer yes.

A Missing Switch

In your response to a reader's question about changing a forgotten screen-saver password in Windows 3.x (Ask Our Advisors, January 21, 1997), you provided information on running a screen saver from an icon. But you forgot to mention that if you simply add scr to the Programs= line in WIN.INI and then click on an icon assigned to Ssflywin.scr, you'll run the Setup dialog for Flying Windows, not the screen saver. In order

HIGHLIGHTS



HARDWARE Want to turbocharge your old system but have only a few hundred dollars to spare? Alfred Poor shows you how. *Page 228*



WORD PROCESSING Use Windows 95's shortcuts to get access to any folder on your system from the File | Open dialog box. *Page 228*



DATABASES Add special animated effects to your Microsoft Access forms by using properties and timer events, to produce color cycling and font- and image-manipulation. *Page 233*

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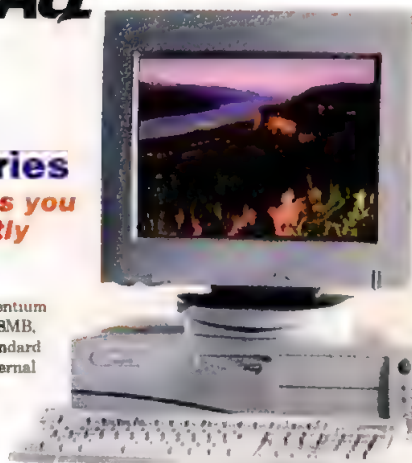


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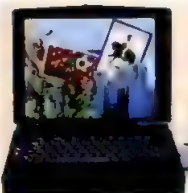


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365XD	133MHz Pentium	8MB	1.35GB	6X	11.3" dual scan	\$2068.99	83366
365XD	133MHz Pentium	8MB	1.35GB	6X	11.3" active matrix	\$2569.92	74050

* Purchase an IBM ThinkPad 365X series notebook and an IBM PC Card modem (CDW 69014, 70635, 64009 or 81049) and receive a \$100 mail-in manufacturer rebate and a free carrying case. Offer valid through 6/31/97.

TEXAS INSTRUMENTS



Extensa 660CD and 660CDT

- ◆ 166MHz Intel Pentium® processor with MMX technology ◆ RAM: 16MB EDO standard, expandable to 80MB ◆ 1.35GB (660CD) or 2.1GB (660CDT) removable hard drive ◆ Removable 10X CD-ROM drive (interchangeable with floppy drive) ◆ 12.1" DSTN dual-scan (660CD) or 11.3" active-matrix (660CDT) SVGA color display

Extensa 660CD	Price drop!	\$2768.04	CDW 83363
Extensa 660CDT	Price drop!	\$3239.24	CDW 83364

Call your CDW account executive about Texas Instruments' Extensa 660 Series and the TransMeta 6600 Series notebooks!

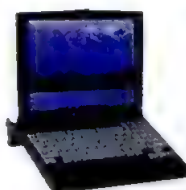
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LifeBook 500 Series

- ✓ 133MHz (531T, 535T) Intel Pentium® processor or 160MHz (555Tx) Intel Pentium processor with MMX Technology ✓ 16MB EDO RAM standard, expandable to 80MB ✓ 1.3GB (531T) or 2GB (535T, 555Tx) hard drive ✓ 10X CD-ROM drive ✓ 11.3" (531T) or 12.1" (535T, 555Tx) SVGA active-matrix color display ✓ Internal 33.6K bps data/fax modem

531T	\$2999.00	CDW 84900
535T	\$3499.00	CDW 85000
555Tx	\$3999.00	CDW 85000

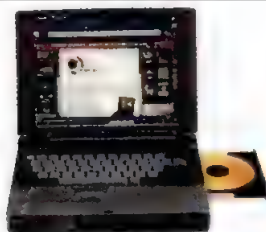


COMPAQ Armada 4100 Series

- ▼ Intel Pentium® processors ▼ RAM: 8MB or 16MB standard, 40MB or 48MB maximum respectively

Shown with optional trackball

Model	CPU	RAM	Hard drive	Color display	Price	CDW
4120	120MHz Pentium	16MB	1.0GB	11.3" dual scan	\$1999.00	71114
4105T	120MHz Pentium	16MB	1.0GB	11.8" active matrix	\$2799.00	71115
4100T	133MHz Pentium	16MB	1.0GB	11.8" active matrix	\$2999.00	71116
4101T	133MHz Pentium	16MB	1.4GB	12.1" active matrix	\$3699.00	80775



TOSHIBA

Satellite 200CDS Satellite 110CS

- ✓ 100MHz Intel Pentium® processor ✓ 8MB EDO RAM standard, 40MB maximum ✓ 810MB hard drive ✓ 6X CD-ROM drive ✓ 11.3" dual-scan SVGA color display
- ✓ 100MHz Intel Pentium® processor ✓ 8MB EDO RAM standard, 40MB maximum ✓ 810MB hard drive ✓ Integrated 1.44MB floppy drive ✓ 11.3" dual-scan SVGA color display

\$1559.41	CDW 77236
\$1277.68	CDW 70247



Satellite Pro 430CDS and 430CDT

- ✓ 120MHz Intel Pentium® processor ✓ 16MB EDO RAM standard, 48MB maximum ✓ 1.2GB hard drive ✓ 10X CD-ROM drive ✓ 11.3" dual-scan (430CDS) or active-matrix (430CDT) SVGA color display

430CDS	\$1969.91	CDW 77242
430CDT	\$2619.41	CDW 77237



Tecra 730CDT

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\$4979.36	CDW 73155
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\$3899.98	CDW 77241
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Tecra 510CDT

Tecra 500CS and 500CDT

- ✓ 120MHz Intel Pentium® processor ✓ 16MB EDO RAM standard ✓ 1.2GB hard drive ✓ Internal 6X CD-ROM drive, swaps with standard 1.44MB floppy drive (500CDT) ✓ 12.1" dual-scan (500CS) or active-matrix (500CDT) SVGA color display ✓ Integrated 28.8K bps fax/modem

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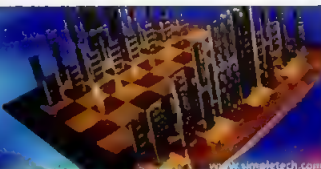
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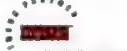
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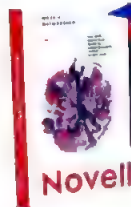
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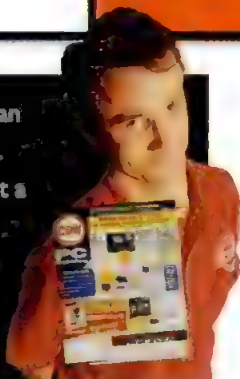


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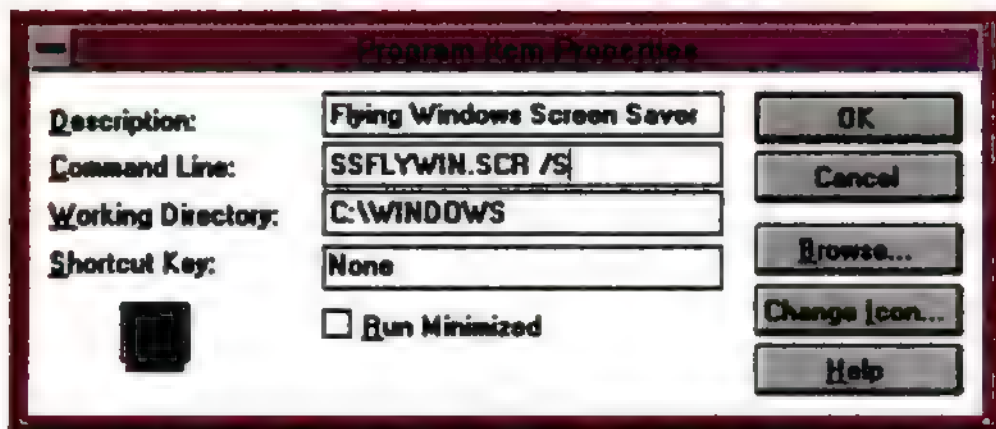


FIGURE 1: After you add scr to the Programs= line in WIN.INI, a program item with properties as shown here will launch the screen saver at your command.

to launch the screen saver rather than Setup, you must include the parameter /s.

WALT SCHUMACHER
Westmont, New Jersey

PC MAGAZINE: Quite a few readers wrote in with this correct advice. Executing a screen saver with no command line switches (or with the /c switch) will run the configuration dialog for that screen saver. To launch a screen saver in its actual screen-saving mode, you must add an /s switch on the command line. Figure 1 shows the correct properties for a program item that will launch a screen saver in Windows 3.x.

Limitations of DOS 7.0's SORT Command

I recently upgraded from a 286 PC running DOS 6.2 to a Pentium/166 running Windows 95. Everything transferred fine except for a couple of old programs written in GW-BASIC. I wrote these programs myself many years ago, on a PC running DOS 2.10 and BASIC. Over the

years, I've always been able to upgrade the programs using the new versions of DOS and BASIC as they came out. I've never found a commercial program that does what I need any better than these.

My problem appeared to be with the DOS SORT command in Windows 95. At different points, my programs use the SHELL command to exit BASIC, run the

SORT command in DOS, then return to BASIC, where the programs use the sorted data. With the new DOS, the SORT command seemed to be limited to entries of 512 characters, including the commas and quotation marks BASIC uses as delimiters and separators.

As long as the data in each entry to be sorted was less than 512 characters long, the SORT command worked fine. But whenever the data went over (and it almost always did), it got completely messed up. I had never had a problem running my programs on any version of DOS until now. The SORT command had always been able to handle entries with a lot of data in them. I didn't understand what was different now.

By chance, I found a simple remedy: a utility called BigSort, available from the ZDNet Web site. BigSort solved my problem, but I'd still like to know what happened.

JIM HACKLEMAN
Indianapolis, Indiana

PC MAGAZINE: It's true—the SORT command supplied with DOS 7.0 (Windows 95's DOS version) breaks down when it has to sort lines

whose length exceeds 510 characters. To confirm this odd behavior for yourself, run the SORTPROB batch file shown in Figure 2. SORTPROB uses DEBUG to create files containing three lines of x's ending in A, B, and C, then reverse-sorts the lines using the SORT command. When the lines are 510 characters long, they sort correctly (though they must wrap to fit on the screen). When they're 511 or more characters long, SORT thoroughly mangles the result.

If you depend on the SORT command to sort long lines, one solution is to find a different sorting utility, as this reader did. Another is simply to use the SORT command from your previous DOS version. The problem is that the old SORT command will complain of an incorrect DOS version. To get around this problem, use the SETVER command, which "lies" about the DOS version to specified programs. Under DOS, loading SETVER requires a specific device= line in your CONFIG.SYS file. Windows 95, on the other hand, automatically loads SETVER (if present) during the boot process. To enable your previous DOS version's SORT command, open a DOS box and issue a command like this:

```
SETVER SORT.EXE 6.22
```

Of course, if your previous version is something other than DOS 6.22, substitute the actual version number. The next time you restart Windows 95, the previous DOS version's SORT.EXE will run correctly. Don't worry about accidentally running the wrong version—once you've made the change using SETVER, the limited DOS 7.0 SORT command is the one that will report "Incorrect DOS version."

```
@ECHO OFF
```

```
:: SORTPROB - Demonstrates a problem with the SORT  
:: command in DOS 7 (Windows 95's DOS version)  
ECHO Creating and sorting a file with 510-char lines
```

```
> TEMP$.SCR ECHO NTEMP$.TXT  
>> TEMP$.SCR ECHO f 100 1 600 'x'  
>> TEMP$.SCR ECHO e 2FD 'A' 0D 0A  
>> TEMP$.SCR ECHO e 4FD 'B' 0D 0A  
>> TEMP$.SCR ECHO e 6FD 'C' 0D 0A  
>> TEMP$.SCR ECHO rcx  
>> TEMP$.SCR ECHO 600
```

```
>> TEMP$.SCR ECHO W  
>> TEMP$.SCR ECHO Q  
DEBUG < TEMP$.SCR > NUL  
SORT /R < TEMP$.TXT  
PAUSE
```

```
ECHO Creating and sorting a file with 511-char lines
```

```
> TEMP$.SCR ECHO NTEMP$.TXT  
>> TEMP$.SCR ECHO f 100 1 603 'x'  
>> TEMP$.SCR ECHO e 2FE 'A' 0D 0A  
>> TEMP$.SCR ECHO e 4FF 'B' 0D 0A
```

```
>> TEMP$.SCR ECHO e 700 'C' 0D 0A  
>> TEMP$.SCR ECHO rcx  
>> TEMP$.SCR ECHO 603  
>> TEMP$.SCR ECHO W  
>> TEMP$.SCR ECHO Q  
DEBUG < TEMP$.SCR > NUL  
SORT /R < TEMP$.TXT  
PAUSE  
ECHO Creating and sorting a file with 512-char lines  
> TEMP$.SCR ECHO NTEMP$.TXT  
>> TEMP$.SCR ECHO f 100 1 606 'x'  
>> TEMP$.SCR ECHO e 2FF 'A' 0D 0A  
>> TEMP$.SCR ECHO e 501 'B' 0D 0A  
>> TEMP$.SCR ECHO e 703 'C' 0D 0A  
>> TEMP$.SCR ECHO rcx  
>> TEMP$.SCR ECHO 606  
>> TEMP$.SCR ECHO W  
>> TEMP$.SCR ECHO Q  
DEBUG < TEMP$.SCR > NUL  
SORT /R < TEMP$.TXT  
DEL TEMP$.*
```



FIGURE 2: This batch file demonstrates that DOS 7.0's SORT command fails on lines longer than 510 characters.

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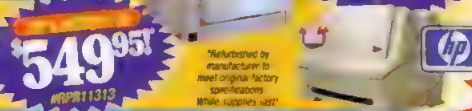
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I have an old 486DX/33 computer with 8MB of memory. I run Windows 95 and some games on it, but the performance is terrible. I would like to upgrade the system, but, unfortunately, I have only a few hundred dollars to spend on the project. Is a new motherboard the right choice, or should I just stick with a memory upgrade, or should I get a graphics accelerator? Which will get me the biggest boost? I hate waiting, and that hourglass is really getting to me.

LUCAS GOTTLER
via the Internet

PC MAGAZINE: The budget is a bit tight, but there are clearly some good choices that you can make. The three most significant factors affecting the general performance of a machine that runs games under Windows 95 are the processor, the amount of memory, and the type of graphics adapter.

If your existing motherboard has a VESA local bus (VL-Bus) slot but you do not have a VL-Bus graphics adapter, obtaining one should be your first consideration. Windows 95 and games are both graphics-intensive applications, and anything you can do to speed the data from your CPU to the display adapter will yield a big performance payoff. You can find brand-name cards for under \$70. If you're going this route, you'll also want to consider adding an Intel 486DX4/100 (the 5-volt variety), because it will take the place of your existing CPU and process internal operations at triple the speed. You can get the bare chip for under \$50 if you're willing to shop around.

If your motherboard does not have a VL-Bus slot, you should think about purchasing a motherboard upgrade; you can get a VL-Bus motherboard with an Intel 486DX4/100 for under \$100 (though you may have to do some shopping around to find one). Then you'll want the VL-Bus graphics adapter to go along with it.

Finally, you'll want at least 16MB of memory for Windows 95; this alone will make a noticeable difference in your system performance. Memory prices are volatile to say the least, but at the time of this writing, it's possible to purchase four 4MB SIMMs for less than \$100.

Buying a new CPU or a motherboard with CPU, a local-bus graphics card, and 16MB of memory should cost less than \$300. If you can use your existing memory, you'll have a

24MB system that won't run like a Pentium but that may be fast enough to keep you from getting annoyed at that hourglass.
—Alfred Poor

OPERATING ENVIRONMENTS

Can Pagefile.sys Be Deleted?



Can you tell me what the Pagefile.sys file in my root directory is used for? This file is 44MB, so I'd like to delete it and regain the disk space if I don't need it.

ETTORE ZUCCARINO
via the Internet

PC MAGAZINE: Pagefile.sys is the default name for the file created and used by Microsoft Windows NT to handle virtual memory. The only situation in which it would be reasonable to delete this file is if you removed Windows NT from your system. If Windows NT is the active operating system, you must not meddle with Pagefile.sys.

Microsoft makes these comments on the size of the paging file:

- The paging file size plus actual physical RAM must be at least 22MB; a total of 40MB would be better.
- The paging file size should be the amount of physical RAM plus 12MB, but it should not be less than 22MB.
- If you have multiple physical drives (not just multiple partitions on a single drive), you can split the paging file across them for increased efficiency.

In short, Pagefile.sys is absolutely essential if Windows NT is present.—Neil J. Rubenking

WORD PROCESSING

Shortcuts for Data Directories



If you've been using WordPerfect for Windows 6.1 and have many documents in the Wpdocs folder, here's a tip for moving to Windows 95 and WordPerfect for Windows 7. The standard installation for WordPerfect 7 creates a folder called MyFiles in the root directory of the drive with WordPerfect and sets it as the default document directory. If you want to keep MyFiles as the default but also want to have quick access to your WP 6.1 Wpdocs folder, you need only create a Windows 95 shortcut to Wpdocs in MyFiles.

To create the shortcut, open two Explorer windows and size them so you can see both at

once. Navigate to whatever folder holds the Wpdocs folder in one window and open the MyFiles folder in the other. Then right-click on the Wpdocs icon and hold the mouse button down as you drag the icon to the MyFiles folder in the second window. When you release the button, Windows 95 will open a menu with choices to Move Here, Copy Here, Create Shortcut(s) Here, or Cancel. Choose Create Shortcut(s) Here. You can now close both Explorer windows. The next time you choose File Open in WordPerfect, the Wpdocs shortcut will show up as one of your choices, and you can simply double-click on it to go to the Wpdocs folder.

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PC MAGAZINE: The possibilities for shortcuts to other directories (or folders if you prefer) go far beyond the simple step of jumping from the MyFiles directory to the Wpdocs directory. Shortcuts will let you build a set of links between directories that is wholly independent of the hierarchy of the directories themselves. They'll let you jump to another directory that's in a separate branch of the directory tree, on another drive in the same computer, or on a network drive on a different system altogether.

This technique also applies to far more applications than just WordPerfect. Because shortcuts are a feature of Windows 95, you can use them with any program that recognizes Windows 95 shortcuts, which should include any program written for Windows 95. It certainly includes both Microsoft Word for Windows 95 and Lotus Word Pro 96 for Windows 95.

If you decide to take advantage of shortcuts to tie directories together, there are some additional issues you'll want to consider. First, note that you'll probably want to include shortcuts in both directions. In Mr. Cable's example, you can jump directly from MyFiles to Wpdocs but can't easily go back to MyFiles. Putting a shortcut to MyFiles in the Wpdocs directory will solve that problem.

Second, keep in mind that you can have as many shortcuts as you like in each directory. That means you can, in theory, set up enough shortcuts to let you jump directly from any directory on any disk to any other directory. As a practical matter, however, having too many shortcuts in any one directory is likely to be more confusing than helpful. You may want to map out a plan for tying your data directories together, choosing any set of links that makes sense to you.

Finally, be aware that there are other ways of creating shortcuts that you may find more convenient. In WordPerfect and Word Pro, you can choose File | Open, right-click on any blank space in the file list box, then choose New | Shortcut. Windows will run a wizard for creating shortcuts. Enter the disk and path for

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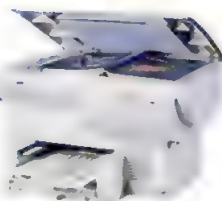


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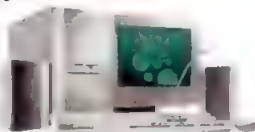
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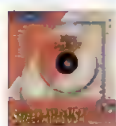
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which you want a shortcut in the Command Line text box, choose Next, enter an appropriate name for the shortcut, and choose Finish.

In Word the procedure is a little different. Choose File | Open, right click on any blank space in the file list box, then choose Explore to open an Explorer window that's open to the same directory. Once in the Explorer window, you can choose File | New | Shortcut or right-click on the blank space in the file list box, then choose New | Shortcut. Either choice will run the wizard for creating a shortcut, as described above.—*M. David Stone*

SPREADSHEETS

File Path Headers for Excel



In Microsoft Word 7.0, I can create a template with a field that shows the complete path and filename of the document I'm writing. I would like to do the same with Excel 7.0. I would like to have the complete path and filename of the worksheet, but in Page Setup, I find I'm capable only of displaying the filename without the path. How can I solve this problem?

ABEER KHEDR
Cairo, Egypt

PC MAGAZINE: You can use the CELL function to display path and file information on your worksheet. Simply enter

=CELL("filename", A1)

into the cell where you want the information to appear. The formula returns the path, filename, and sheet name of the cell reference—A1, in this example. You can use the CELL function to get the specs on any sheet; it doesn't have to be the sheet at which you're currently looking. It also doesn't matter whether the cell you specify in the function's second argument is empty or in use. You can even create a circular reference with this function—for example, you can enter =CELL("filename", A1) in cell A1 and Excel won't complain.

I suspect from your reference to the Page Setup command, however, that you're wishing Excel could automatically enter this path-and-file data into a header or footer. And you're right; Excel does not provide a way to do that automatically. The way to solve the problem is to use Print Titles. The Print Titles field, on the Sheet tab of the Page Setup dialog box, lets you repeat the contents of specified rows or columns at the top of every printout page.

So, for example, you could use the CELL function somewhere in row 1 to display the filename and path specification for your worksheet. Then designate row 1 as a print

title. To make the print title appear where a header would, reduce the top margin for your printout, using the Margins tab of the Page Setup dialog box.

If you don't want the sheet name to appear in the print title, follow these steps:

- Create your CELL formula, as described above.
- Before pressing Enter at the end of the formula, press F9. That causes Excel to enter the calculated result of your CELL formula, not the formula itself, into the current cell.
- Then press F2 and backspace over the sheet name.—*Craig Stinson*

DATABASES

Special Effects for Access Forms



While writing an equipment-management system in Microsoft Access 2.0 for a local company, I became impressed with the power hidden within Access. Although I'm partial to extensive printed technical documentation and Access has shortcomings in this area, the program is a pleasure to work with.

The enclosed sample database contains one form called About. The form exploits some of the lesser-used form properties of Access to produce some neat effects, such as color cycling and font and image manipulation. These effects don't serve any obvious practical purposes, but they do offer suggestions as to how to create more powerful—or perhaps more professional-looking—forms.

When my About form is initially opened, a message comes into view in a label box. The message is initially too small to read but in increments becomes larger and larger until it fills the message box. Then the background color of the message box begins to cycle. Both of these effects are accomplished by manipulating the property values of the label in response to the Timer event. The code that does this is shown in Figure 1.

The form also contains two buttons. Clicking OK will close the form. Clicking Not OK is not possible, because as soon as the mouse pointer is moved over the Not OK button, the button disappears and reappears elsewhere. To do this I manipulate the Visible property on two identical buttons in response to the MouseMove event.

On the right side of the form is a picture taken in my eighth-grade year. When you move the mouse pointer over the picture, the picture changes. My revised likeness includes glasses, mustache, and beard. This is also accomplished by manipulating the Visible property in response to MouseMove events.

The examples shown in the sample database were written with the intention of sprucing up my About Program window. They suggest

what can be done with Access's versatility and a little imagination.

ROBERT MORTON
www.gosupersonic.com

PC MAGAZINE: The events and properties in Access provide lots of opportunities for creativity. Here, Mr. Morton makes use of two of Access's form-level features—the Timer event and the Timer Interval property—as well as four control-level features—the MouseMove event and the FontSize, Backcolor, and Visible properties—to produce a number of interesting effects.

The first effect steadily increases the size of text on a label, to animate the text and create the illusion that the text is moving towards you. This is accomplished by placing code in an event procedure attached to the Form's On Timer property, to change the FontSize of the text. The procedure is called whenever a timer event occurs, which is usually quite often.

You can specify just how often by setting the Form's TimerInterval property. This property setting is a Long Integer value between 0 and 2,147,483,647 that represents the number of milliseconds between timer events. You can set it by using the form's property sheet, a macro, or Visual Basic (in the handler for the form's Load event). Since 1 second is 1,000 milliseconds, to make a timer event happen every second you must set the TimerInterval property to 1,000. Keep in mind that the system clock ticks about every 55 milliseconds, so you shouldn't set TimerInterval below this for an animation. To prevent Timer events from occurring at all, set the TimerInterval property to 0.

The Timer event and the TimerInterval property provide you with an opportunity to perform some action at regular intervals, such as requerying rows or refreshing the display. The TimerInterval and the Timer event are often used to support animation and the kinds of special effects we're discussing here.

To animate the text, you place code in the OnTimer event procedure to increase the size of the text every time the event procedure is called, until the target size for the text is reached. In the example code shown in Figure 1, the text is increased until it reaches 11 points by the following line from the On Timer event procedure:

```
If [MyLabel].FontSize < 11 Then
[MyLabel].FontSize =
[MyLabel].FontSize + 1
```

MyLabel is the name of the label containing the text. For this to work correctly, you must remember to set the label's default FontSize property to an appropriately small value in the label's Properties sheet, so that it starts out low and increases towards the target size. In this case the default font size for the label is set to 1 point. You must also set the form's Timer-

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```

Private Sub Form_Timer()
'*****
' Private Sub Form_Timer() - Called when a Timer Event occurs
'*****
    Static Elapsed As Integer
    '
    ' Increment the FontSize to create the Approaching Text effect
    '
    If [MyLabel].FontSize < 11 Then [MyLabel].FontSize = [MyLabel].FontSize + 1

    If Elapsed > 5 * 10 Then ' To let the Approaching Text effect happen
                            ' first
        '
        ' Cycle the Background colors
        '
        If [MyLabel].BackColor > 16777215 Then
            [MyLabel].BackColor = 0
        Else
            [MyLabel].BackColor = [MyLabel].BackColor + 1000
        End If
    Else
        Elapsed = Elapsed + 1
    End If
End Sub

```



FIGURE 1: You can create special effects on a form in Access by manipulating control properties in response to the Timer event.

Interval to a value that provides for smooth animation. In this case Mr. Morton chose 100 milliseconds, or one tenth of a second, which works well. If you make this value smaller, you increase the speed of the animation.

The second effect demonstrated in Mr. Morton's sample database is cycling the label's background color. The technique is essentially the same as that used for sizing the text: you place code in the event procedure attached to the form's On Timer property, and that code programmatically alters one of the label's properties, in this case the BackColor property.

The BackColor property contains a numeric expression that corresponds to the color used to fill a control or section's interior. You usually set this property interactively by clicking the Build button to the right of the property box in the property sheet. Doing so brings up the Color Builder, which lets you easily select a color or define custom colors for controls or sections. To cycle through a suite of different colors, however, you have to alter the property directly in code.

The logic is simple: each time a Timer event occurs, the code in the Form's On Timer event procedure increases the value assigned to the label's BackColor property by 1,000, until it reaches a target value. When it reaches the target value, BackColor is reset to 0, so that it starts over again. In this way the background color is repeatedly cycled.

You can create some other interesting effects by detecting mouse movement and manipulating the Visible property available

on controls, forms, and reports. The sample database demonstrates one example by making the Not OK button disappear and reappear elsewhere when you try to click it with the mouse (I tried to catch it and couldn't).

To detect when the mouse pointer is moved over a control, you place code in an event procedure attached to the control's On MouseMove property. This event procedure will be called whenever a MouseMove event occurs and the mouse is positioned within the control's borders.

MouseMove events are common. For one thing, they happen all the time—whenever the mouse is moved. They also can occur when the mouse stays still and an object is moved underneath the mouse. For example, if you drag an object such as a form underneath a stationary mouse pointer, MouseMove events occur. The events are recognized by the object whose borders contain the mouse pointer. Note that not all objects recognize MouseMove events. For example, MouseMove events do not apply to controls on a report.

Because MouseMove events are sent to the object containing the mouse, making the object disappear is a simple matter of placing code in the object's MouseMove event procedure to set its Visible property to False, like this:

```
Me! [Button].Visible = False
```

You use the Visible property to show or hide a form, report, or control. Setting the proper-

ty to True makes the object visible. Setting it to False hides it.

As the sample database demonstrates, you can include other code in this procedure that makes another look-alike button visible. In Mr. Morton's example, two identical Not OK buttons are created, one on each side of the OK button. The Visible properties on the two Not OK command buttons are then manipulated in response to MouseMove events, so that each button becomes visible when the other becomes invisible, creating the illusion that only one button exists and that it is disappearing and reappearing elsewhere.

For example, code in Button1's MouseMove event procedure might look like this:

```
Me! [Button1].Visible = False
Me! [Button2].Visible = True
```

The code in Button2's MouseMove procedure would look like this:

```
Me! [Button1].Visible = True
Me! [Button2].Visible = False
```

That ensures you'll be chasing buttons all evening.

The final example in the sample database takes the use of the Visible property and the MouseMove event and applies it to images. If you place two images of the same size on a form, one precisely above the other, you can manipulate each one's Visible property to create the appearance of one image that changes when the Mouse pointer is placed within its borders.

The sample database form can be downloaded from PC Magazine Online. Look for the file FORMFX.ZIP in the volume archive v16n10.zip.—Sal Ricciardi

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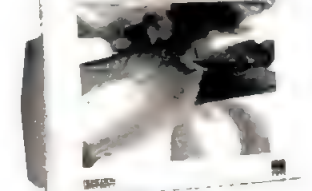
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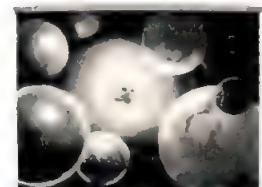
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DeskJet 340	\$239
DeskJet 400C Printer	\$179
DeskJet 692C	\$299
DeskJet 820C/870 CXI	\$379/\$489
DeskJet 1600C/CM Printer	\$1289/\$1869
LaserJet 5L-FS	\$389
LaserJet 6P/6MP	\$719/\$879
OfficeJet 330 (Printer/Fax/Copier/Scanner)	\$499

EPSON

DFX-5000+/8000	\$1395/\$2329
Stylus Color 400	\$229
Stylus Color 600	\$299
Stylus Color 800	\$449
Stylus 1500 (up to 17x22)	\$995
Stylus Pro XL (24pp Microsoft up to 13x19)	\$1449

OKIDATA PRINTERS

OkPage 4W (Windows Only)	\$299
OK600e/OK610e/OK810e	\$399/\$499/\$699
ML320/ML321 Turbo	\$319/\$449
ML590/ML591	\$449/\$609

CANON

BJC-240	\$179
BJC-4200	\$229
BJC-4550 (up to 11x17)	\$499
BJC-620	\$399
LBP-465 (Laser)	\$359
C2500 (Fax, Scanner, Printer, Copier)	\$599

LEXMARK

Winwriter 150C	\$185
Color Jetprinter 1020/2070	\$145/\$339
Color Jetprinter 2050	\$249
2300/2351 Plus Dot Matrix Printer	\$315/\$425
2300/2491 Plus Dot Matrix Printer	\$359/\$465
4079 Plus	\$2489
4226 Dot Matrix	\$1269
4039 10 Pins	\$1069
Optra E	\$539
Optra R+/OptraR+	\$1249/\$1749
Optra Lx+/Optra Lx+	\$1859/\$2229
Optra C	\$989
Optra V/Optra V w/16MB RAM	\$2679/\$3379

NEC

SuperScript 860 (Laser)	\$439
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*Price after manufacturer's mail-in rebate. Ask your salesperson for details.

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S64 P166 16MB 2.5GB w/15" Monitor w/17" Monitor	\$2999/\$3299
S66 P166 16MB 2.5GB w/15" Monitor w/17" Monitor	\$3149/\$3449
S74 P200 16MB 2.5GB w/15" Monitor w/17" Monitor	\$3299/\$3599
S78 P200 16MB 2.5GB w/15" Monitor w/17" Monitor	\$3399/\$3699

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DeskPro 2000 P133 16MB 1.2GB	\$1169
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DeskPro 4000 P133 16MB 1.0GB	\$1299
DeskPro 4000 P166 32MB 1.6GB 8X CD-ROM	\$2099
DeskPro 6000 P166 32MB 2.1GB	\$2599
DeskPro 6000 Pentium Pro 200 32MB 2.1GB 8X CD-ROM	\$3249

USA FLEX SYSTEMS

The Starter Special P120 16MB 1.2GB MT 1X 17" P3000	\$1399
Multimedia Tower P2000 16MB 32MB 60GB 12X 17" P3000	\$3699
Family Classic P166 16MB 2.5GB MT 12X 15" ZIP Drive	\$1997
Multimedia Classic P166 16MB 32MB 60GB MT 12X 17" HP 042	\$2699
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Business Workstations starting at Custom Systems Available-All your flex sales representative for full details	\$1199

HP VECTRA 500 SERIES

510CD 5.100 P100 8MB 1.2GB 4X	\$1099
515 5.133 P133 8MB 1.2GB	\$1199
515MCX 5.100 P100 8MB 1.2GB 4X Sound, Telephone	\$1299
515MCX 5.133 P133 16MB 256K 1.6GB 8X Sound, Telephone	\$1599
515MCX 5.166 P166 16MB 256K 2.5GB 8X Sound, Telephone	\$1999

IBM, HP & AST models do not include monitor unless otherwise stated.

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EPSON

PhotoPlus Scanner	\$199
Action Scanner II	\$403
ES1000C	\$539
Flatbed Scanner 636 (Pro)	\$846
Flatbed Scanner 636 (Artist)	\$1275
Flatbed Scanner 636 (Exec)	\$891

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31562	5133/100	Pentium 133	256K	1.2GB	16MB/128MB	1190
31563	5133/100	Pentium 133	256K	2.5GB	16MB/128MB	1290
31806	5133/100	Pentium 133	256K	2.5GB	16MB/128MB	1390
31564	5133/100	Pentium 166	256K	1.2GB	16MB/128MB	1340

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32276	BM PC 340	Pentium 100	1.2GB	16MB/128MB	880
32278	BM PC 340	Pentium 133	1.2GB	16MB/128MB	1190
35422	BM PC 340	Pentium 133	1.2GB	16MB/128MB	1140
35424	BM PC 340	Pentium 166	1.0GB	16MB/128MB	1340
35423	BM PC 340	Pentium 166	2.5GB	16MB/128MB	1400

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37605



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32140	Pentium 100	256K	410MB	8MB/640MB	1MB/1MB	8X	\$299
37608	Pentium 120	256K	250MB	8MB/128MB	1MB/1MB	8X	\$499
37609	Pentium 133	256K	1.6GB	16MB/128MB	1MB/1MB	8X	\$1049
37605	Pentium MMX 200	512K	2.5GB	32MB/128MB	4MB/4MB	12X	\$1999

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37039	365XD-FE9 2625-FE9	Pentium/133	11.3" Active	1.35GB	8MB/40MB	N/A	\$2299
37038	365XD-GE9 2625-GE9	Pentium/120	10.4" Active	1.08GB	8MB/40MB	N/A	\$2399
32973	365XD 2625-1E9	Pentium/133	11.3" Active	1.35GB	8MB/40MB	N/A	\$2799
32972	365X133-DS 2625-2E9	Pentium/133	11.3" Passive	1.08GB	8MB/40MB	N/A	\$1799



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TOSHIBA

PC Item #	Model	Processor Speed (MHz)	Hard Drive	RAM	Warranty	CD-ROM	Price
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Toshiba Satellite Pro 430 Models



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PC Item #	Model	Processor Speed (MHz)	Hard Drive	CD-ROM	Price
35175	Satellite Pro 430CDS	Pentium/120	1.35GB	10X	\$1999
26177	Satellite Pro 430CDS	Pentium/120	1.35GB	10X	\$2999

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510CPI, Pent-133, 16MB, 2.1GB, 12.1" TFT, 10X, 28.8	\$4,083
700CPI, Pent-150, 16MB, 2GB, 12.1" TFT, 10X, 28.8	\$5,229
700CPI, Pent-150MMX, 16MB, 2GB, 12.1" TFT, 10X, 28.8	\$5,520
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365DS, Pent-133, 8MB, 1.3GB, 11.3" DS, 4X	\$2,226
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P50, Pent-133, 24MB, 1GB, 12.1" TFT, 4X, 28.8	\$3,629
P50, Pent-133, 24MB, 2.1GB, 12.1" TFT, 4X, 28.8	\$3,999
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- Large Ctr Display • 6X CD-ROM

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HP DeskJet 870C	\$484
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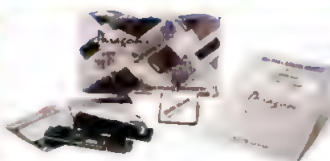
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14000	0405000	..\$179	2300	n/a	..\$38
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16AB	PC AC2012U			8195	
1180, 1190, 1210, 1215, 1240, 1400, 1410, 1415, 1420, 1425, 1430				1180	
1435, 1440, 1445, 1450, 1455, 1460, 1465, 1470, 1475				1470	
4AB	PC AC2012U	569	16AB	PC AC2012U	5145
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1240	PC AC2012L			894	

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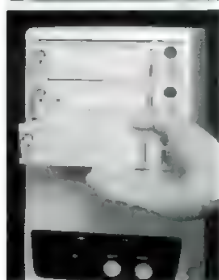
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1200MB	14ms	4103	JTS	JTS1200	3	\$179
1275MB	12ms	4900	Seagate	TM31276A	3	\$195
1280MB	11ms	4500	Quantum	TM31280A	3	\$192
1281MB	11ms	5200	Western Digital	WDAC11200	3	\$199
1624MB	10ms	5200	Western Digital	WDAC11600	3	\$209
1670MB	11ms	4480	Maxtor	M81750A	3	\$210
1700MB	10ms	5400	Fujitsu	M1623T	3	\$194
1700MB	12ms	4900	Seagate	ST31720A	3	\$205
2000MB	14ms	4103	JTS	JTS2000	3	\$219
2100MB	9ms	5400	Fujitsu	M1624T	3	\$224
2111MB	12ms	5200	Western Digital	WDAC22100	3	\$229
2132MB	12.5ms	4500	Seagate	ST32132A	3	\$229
2151MB	10ms	5400	Quantum	FB32160A	3	\$259
2168MB	10.5ms	4500	Quantum	TM32160A	3	\$235
2187MB	12ms	4480	Maxtor	M82187A	3	\$239
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2550MB	15ms	3600	Quantum	BF2500A	3	\$225
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2559MB	11ms	5200	Western Digital	WDAC25500	3	\$255
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2560MB	10ms	5400	Maxtor	M82560A	3	\$259
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3228MB	10ms	5400	Quantum	FB32240A	3	\$309
3245MB	12ms	4500	Seagate	ST3240A	3	\$315
3254MB	10.5ms	4500	Quantum	TM32200A	3	\$285
3500MB	12ms	4480	Maxtor	M83500A	3	\$329
3840MB	10.5ms	4500	Quantum	TM3840A	3	\$315
4000MB	12ms	5200	Western Digital	WDAC34000	3	\$375
4310MB	10ms	5400	Quantum	FB34320A	3	\$375
4326MB	12ms	4500	Seagate	ST34340A	3	\$341
4333MB	14ms	3600	Quantum	BF4335A	3	\$294
5120MB	10ms	5400	Maxtor	M85120A	3	\$449
6448MB	10ms	5400	Quantum	FB64480A	3	\$539
6510MB	14ms	3600	Quantum	BF6510A	3	\$439

SCSI HARD DRIVES

SCSI	Speed	RPM	Brand	Model	Qty	Int	Ext
1050MB	9ms	5400	Seagate	ST31055N	3	\$299	\$369
1280MB	12ms	4500	Quantum	TM31280S	3	\$269	\$339
2110MB	10.5ms	4500	Quantum	TM32110S	3	\$109	\$179
2150MB	9ms	5400	Seagate	ST32155N	3	\$475	\$545
2150MB	8ms	7200	Seagate	ST32171N	3	\$648	\$719
2151MB	10ms	5400	Quantum	FB32160S	3	\$158	\$409
3228MB	10ms	5400	Quantum	FB32240S	3	\$189	\$458
3254MB	10.5ms	4500	Quantum	TM32550S	3	\$155	\$425
4100MB	2.8ms	7200	Microplis	MC4341	3	\$738	\$809
4310MB	10ms	5400	Quantum	TM33200S	3	\$478	\$549
4310MB	8ms	7200	Seagate	ST34371N	3	\$989	\$1059
4400MB	8ms	7200	Fujitsu	MD2954S	3	\$799	\$868
4550MB	8ms	7200	Quantum	XP34550S	3	\$879	\$948
4550MB	7.9ms	7200	Microplis	MC4345S	3	\$825	\$895
4550MB	7.9ms	7200	Microplis	MC4345AV	3	\$909	\$979
6448MB	10ms	5400	Quantum	FB36480S	3	\$159	\$668
9091MB	8.5ms	7200	Microplis	MC3391	3	\$1345	\$1415
9091MB	8.5ms	7200	Microplis	MC3391AV	3	\$1459	\$1529
9100MB	8ms	7200	Seagate	ST19171N	3	\$1868	\$1939
9100MB	8ms	7200	Quantum	XP39100S	3	\$1889	\$1948
9100MB	10ms	7200	Fujitsu	MD2949S	3	\$1439	\$1509
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1050MB 9ms 5400 Seagate ST31055N 3 \$269 \$369

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9091MB 8.5ms 7200 Microplis MC3391W 3 \$1455 \$1585

9091MB 8.5ms 7200 Microplis MC3391WAV 3 \$1569 \$1689

9100MB 8ms 7200 Quantum XP39100W 3 \$1599 \$1739

9100MB 8ms 7200 Fujitsu MD2949W 3 \$1559 \$1689

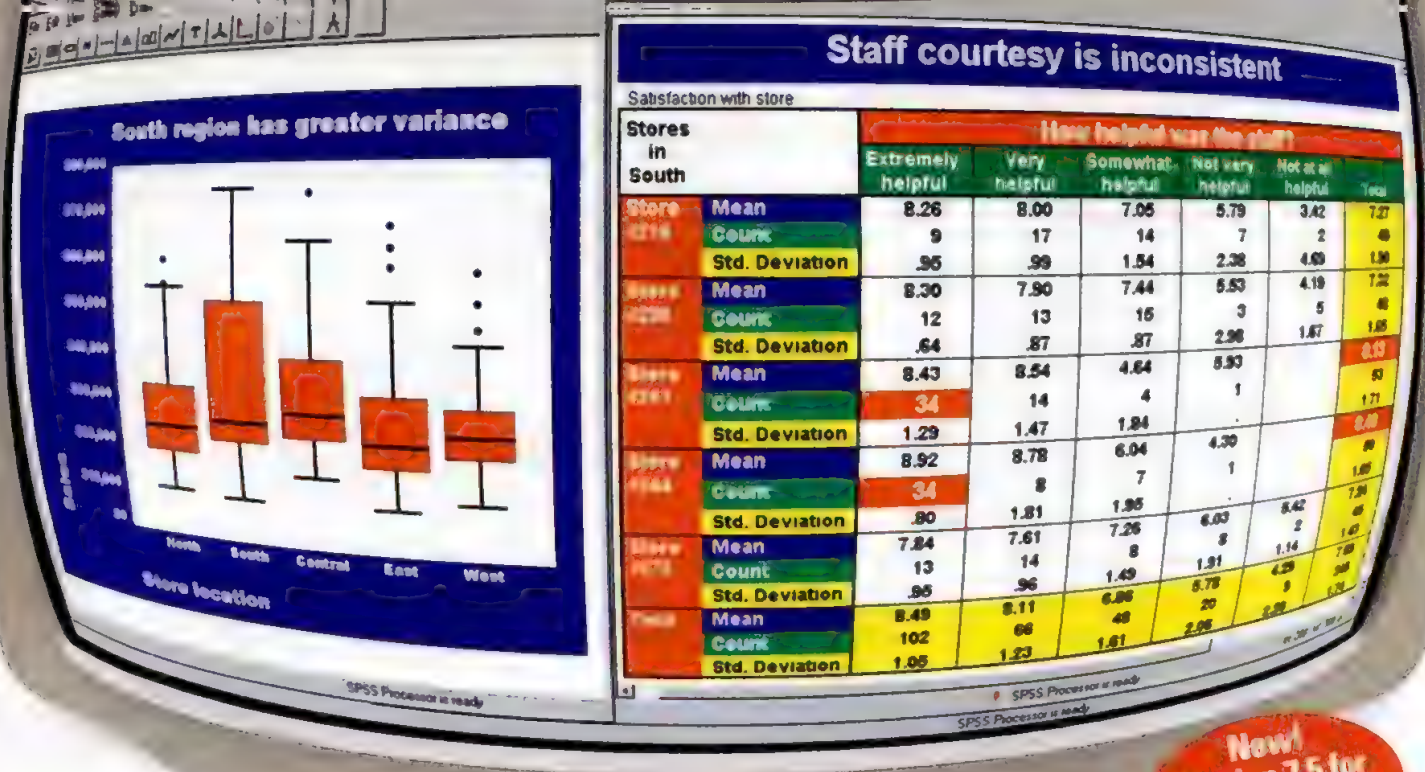
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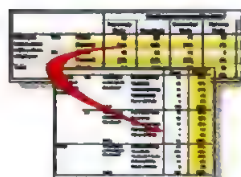
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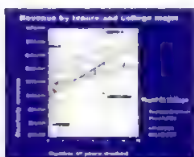
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PC 130 Model 657T (ECC)	44Meg 16Meg 32Meg	24,495/160
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PS 1 72 Pin Series	44Meg 16Meg 32Meg	24,495/160
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PS 2 355A, ECC, pairs	44Meg 16Meg 32Meg	24,495/160
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Compaq 4500 Series	130	TI Versa 450 455 510 515	140
Epson Action Note 650 660	110	TI Versa 550 555 560 570	140
Epson Action Note 800 805 810	110	TI Versa 650 655 660	140
IBM Thinkpad 350, 360	110	Toshiba 400 410 420 430 430 430	210
IBM Thinkpad 385 C, ED 30	120	Toshiba 110 115 120 205	105
IBM Thinkpad 720	170	Toshiba 2100 Series	105
IBM Thinkpad 750 C, ED	170	Toshiba 2400 2450 1920 1950 1960	105
NEC Versa 2400 2450 2460 2475	150	Toshiba 4700 4800 4800 4800	105
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Toshiba 7800	44Meg 16Meg 32Meg	70/120/200/300/400/500
Toshiba 7900	44Meg 16Meg 32Meg	70/120/200/300/400/500
Toshiba 8000	44Meg 16Meg 32Meg	70/120/200/300/400/500
Toshiba 8100	44Meg 16Meg 32Meg	70/120/200/300/400/500
Toshiba 8200	44Meg 16Meg 32Meg	70/120/200/300/400/500
Toshiba 8300	44Meg 16Meg 32Meg	70/120/200/300/400/500
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NOTEBOOK, LAPTOP MEMORY

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ACER Versa 7600, 7650, 7700, 7750, 7800	44Meg 16Meg 32Meg	30/50/80/110/140/170
ACER Versa 7900, 7950, 8000, 8050, 8100	44Meg 16Meg 32Meg	30/50/80/110/140/170
ACER Versa 8200, 8250, 8300, 8350, 8400	44Meg 16Meg 32Meg	30/50/80/110/140/170
ACER Versa 8500, 8550, 8600, 8650, 8700	44Meg 16Meg 32Meg	30/50/80/110/140/170
ACER Versa 8800, 8850, 8900, 8950, 9000	44Meg 16Meg 32Meg	30/50/80/110/140/170
ACER Versa 9100, 9150, 9200, 9250, 9300	44Meg 16Meg 32Meg	30/50/80/110/140/170
ACER Versa 9400, 9450, 9500, 9550, 9600	44Meg 16Meg 32Meg	30/50/80/110/140/170
ACER Versa 9700, 9750, 9800, 9850, 9900	44Meg 16Meg 32Meg	30/50/80/110/140/170
ACER Versa 10000, 10050, 10100, 10150, 10200	44Meg 16Meg 32Meg	30/50/80/110/140/170

IBM NOTEBOOK & LAPTOP MEMORY

IBM Thinkpad 345, 355, 360, C, CE	44Meg 16Meg 32Meg	49,780/143
Thinkpad 365C, C2, C, ED	44Meg 16Meg 32Meg	49,780/143
Thinkpad 365S, 365S, 365S	44Meg 16Meg 32Meg	49,780/143
Thinkpad 500 5100S	44Meg 16Meg 32Meg	49,780/143
Thinkpad 500 720 730 740 750	44Meg 16Meg 32Meg	49,780/143
Thinkpad 701 701C	44Meg 16Meg 32Meg	49,780/143
Thinkpad 720T, 720T, 720T	44Meg 16Meg 32Meg	49,780/143
Thinkpad 735C, C, ED, C, ED	44Meg 16Meg 32Meg	49,780/143
Thinkpad 740C, C, L, L2	44Meg 16Meg 32Meg	49,780/143
Thinkpad 745C, C, L, L2, L2	44Meg 16Meg 32Meg	49,780/143

COMPAG MEMORY MODULES

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Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100

COMPAG NOTEBOOK/LAPTOP MEMORY

Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100
Compaq 486, 486, 33, 30, 30	24Meg 16Meg 32Meg	29,790/100

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760E	150MHz	16MB	2.1GB	—	12.1" Active	183	4897
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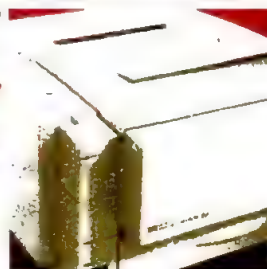
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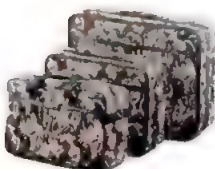


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5300	133MHz	12.1" Active	16MB, 1.35GB	Opt	\$3859
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Model	CPU	Screen	RAM/HD	CD Price
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Model	CPU	Screen	RAM/HD	CD Price
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6050	150MHz	12.1" Active	16MB/1.35GB 10X	3299
6160	166MHz MMX	12.1" Active	32MB/2.1GB 10X	4899

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730XCDT	P150MHz MMX	12.1" Active	16MB/2.0GB	10X	\$5379
Compaq					
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Fujitsu					
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NEC					
6200MX	166MHz MMX	13.3" Active	32MB/2.1GB	10X	\$6399
Hitachi					
MMX166T	166MHz MMX	12.1" Active	16MB/2.1GB	8X	\$4799
Texas Instruments					
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S9C	200MHz MMX	32MB/4.2GB	16X	\$2599
Compaq				
4764	166MHz MMX	24MB/2.5GB	16X	\$1799
AST				
9402	166MHz MMX	32MB/2.0GB	16X	\$1799
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VAJO	166MHz MMX	32MB/2.5GB	16X	\$1999
Toshiba				
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NEC				
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Model	CPU	RAM/HD	CD	Price
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PowerMate	P166MHz MMX	16MB/2.0GB	Opt.	\$1893
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Celebris FX	P200MHz MMX	32MB/2.1GB	8X	\$2399
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S8C	166MHz MMX	32MB/3.2GB	16X	2349
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Model	Size	View	Resolution	Price
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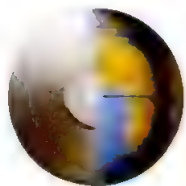
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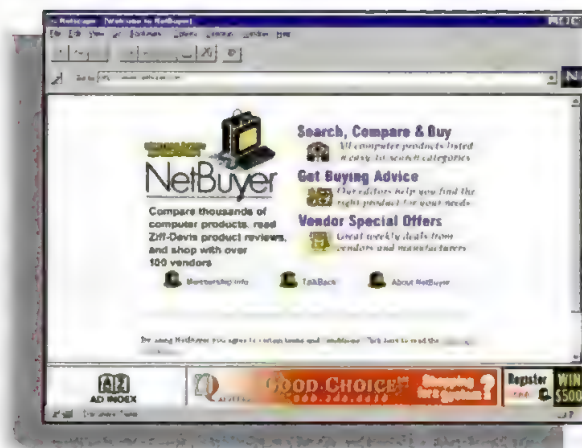
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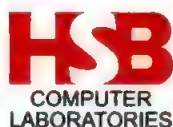
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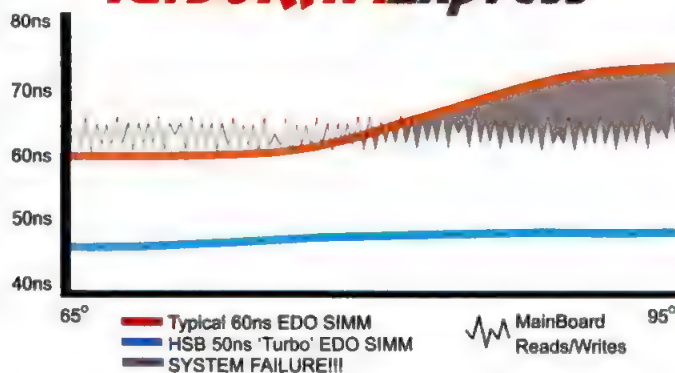
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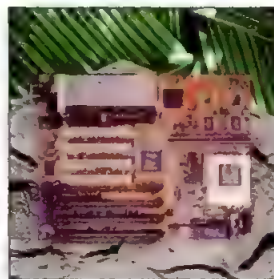
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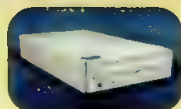
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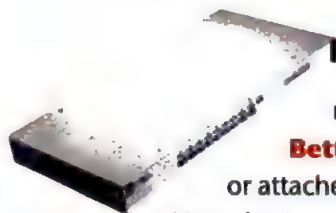
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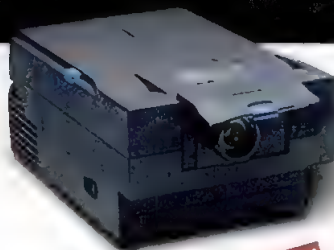


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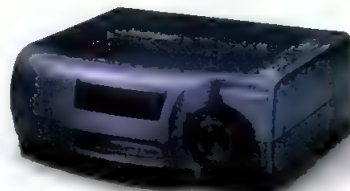
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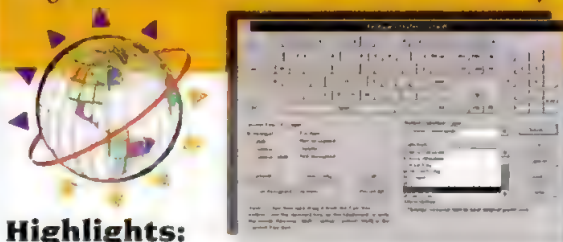
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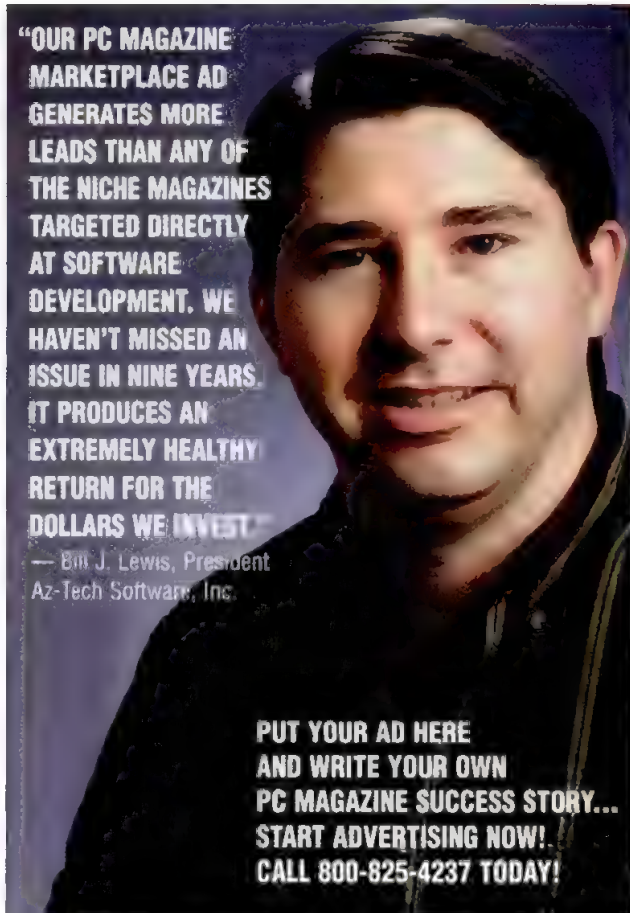
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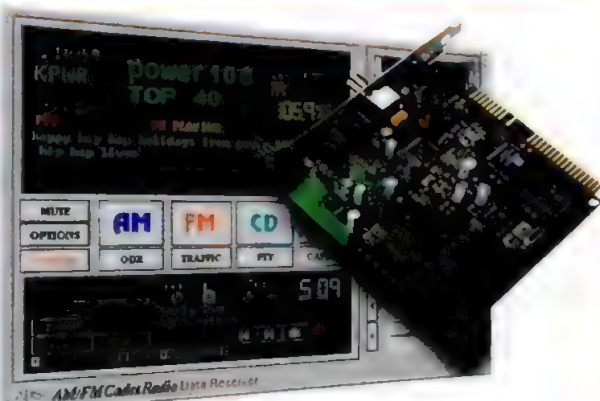
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4.0GB Conner 4000I	\$349	
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7.0GB Exabyte 8205XL	\$699	
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1.0GB IBM DFHS-W	\$269
1.0GB Quantum 31070W	\$269
2.0GB IBM DORS-W	\$399
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2.0GB Quantum 32151W	\$439
2.0GB Quantum 32170W	\$409
2.0GB Quantum 3210W	\$349
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2.0GB Seagate 32550W	\$649
2.0GB Seagate 32155W	\$489
2.0GB Seagate 32171W	\$539
4.0GB IBM DCAS-W	\$829
4.0GB Micropolis 4345W	\$939
4.0GB Quantum 34301W	\$829
4.0GB Quantum 34300W	\$849
4.0GB Quantum 34550W	\$899
4.0GB Seagate 15150W	\$959
4.0GB Seagate 34371W	\$979
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730MB IBM DB04-2720	\$209
810MB Fujitsu 2713TA	\$219
810MB IBM DVAA-2810	\$229
810MB Quantum 1010E	\$229
810MB Toshiba NK1926FCV	\$219
1.0GB Fujitsu 2714TA	\$249
1.0GB IBM SANADA 21000	\$249
1.0GB Toshiba MK1002MAV	\$259
1.3GB IBM DPRA-2121S	\$329
1.3GB Seagate 91350A	\$339
1.3GB Toshiba 2720FC	\$339
1.3GB Toshiba 1301MAV	\$349
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	100	133	150	166	200
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MMX	N/A	N/A	N/A	\$437	\$615
PRO	N/A	N/A	\$218	N/A	\$730
Cyrix 6x86	N/A	N/A	\$120	\$156	\$244
AMD K5	\$76	\$92	\$172	N/A	N/A

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8MB 72 pin	\$25	16MB 72 pin	\$35
16MB 72 pin	\$35	32MB 72 pin	\$45
32MB 72 pin	\$45	64MB 72 pin	\$55
64MB 72 pin	\$55	128MB 72 pin	\$65
128MB 72 pin	\$65	256MB 72 pin	\$75
256MB 72 pin	\$75	512MB 72 pin	\$85
512MB 72 pin	\$85	1GB 72 pin	\$95

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Model	Price	Model	Price
4MB 168 pin	\$15	8MB 168 pin	\$25
8MB 168 pin	\$25	16MB 168 pin	\$35
16MB 168 pin	\$35	32MB 168 pin	\$45
32MB 168 pin	\$45	64MB 168 pin	\$55
64MB 168 pin	\$55	128MB 168 pin	\$65
128MB 168 pin	\$65	256MB 168 pin	\$75
256MB 168 pin	\$75	512MB 168 pin	\$85
512MB 168 pin	\$85	1GB 168 pin	\$95

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16MB 70 pin	\$35	32MB 70 pin	\$45
32MB 70 pin	\$45	64MB 70 pin	\$55
64MB 70 pin	\$55	128MB 70 pin	\$65
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128MB 168 pin	\$65	256MB 168 pin	\$75
256MB 168 pin	\$75	512MB 168 pin	\$85
512MB 168 pin	\$85	1GB 168 pin	\$95

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16MB 168 pin	\$35	32MB 168 pin	\$45
32MB 168 pin	\$45	64MB 168 pin	\$55
64MB 168 pin	\$55	128MB 168 pin	\$65
128MB 168 pin	\$65	256MB 168 pin	\$75
256MB 168 pin	\$75	512MB 168 pin	\$85
512MB 168 pin	\$85	1GB 168 pin	\$95

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Model	Price	Model	Price
4MB 168 pin	\$15	8MB 168 pin	\$25
8MB 168 pin	\$25	16MB 168 pin	\$35
16MB 168 pin	\$35	32MB 168 pin	\$45
32MB 168 pin	\$45	64MB 168 pin	\$55
64MB 168 pin	\$55	128MB 168 pin	\$65
128MB 168 pin	\$65	256MB 168 pin	\$75
256MB 168 pin	\$75	512MB 168 pin	\$85
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16MB 168 pin	\$35	32MB 168 pin	\$45
32MB 168 pin	\$45	64MB 168 pin	\$55
64MB 168 pin	\$55	128MB 168 pin	\$65
128MB 168 pin	\$65	256MB 168 pin	\$75
256MB 168 pin	\$75	512MB 168 pin	\$85
512MB 168 pin	\$85	1GB 168 pin	\$95

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16MB 168 pin	\$35	32MB 168 pin	\$45
32MB 168 pin	\$45	64MB 168 pin	\$55
64MB 168 pin	\$55	128MB 168 pin	\$65
128MB 168 pin	\$65	256MB 168 pin	\$75
256MB 168 pin	\$75	512MB 168 pin	\$85
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8MB 72 pin \$38	16MB TOSHIBA 710 \$169	LJ 5 \$1195
16MB 72 pin \$75	32MB TOSHIBA 500 \$295	LJ 5M \$1645
32MB 72 pin \$150	16MB DELL XPI \$169	LJ 6MP \$879
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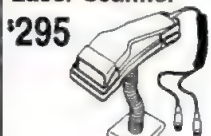
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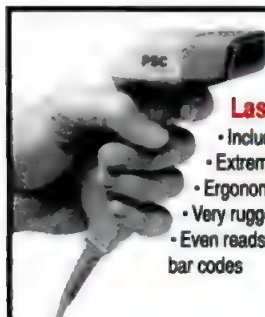
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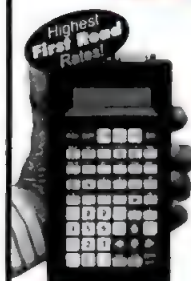
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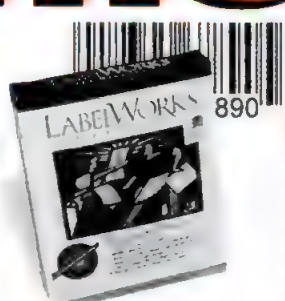
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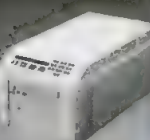
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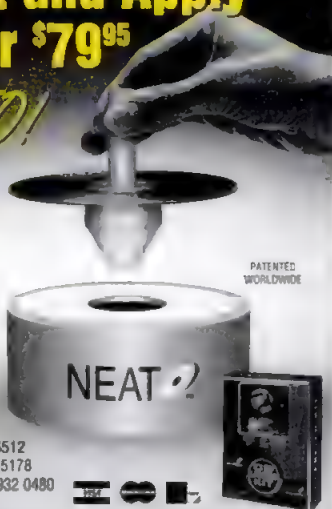
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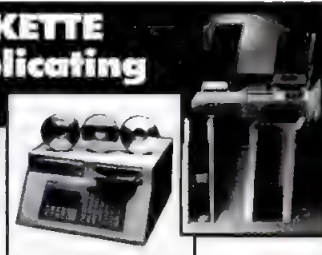


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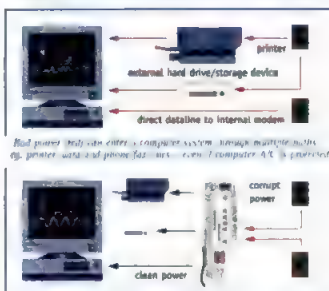
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After Hours

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Under Your Thumbs

Need a good controller for your arcade-style games? Try one of these game pads.

Joysticks are wonderful devices for controlling flight simulations and for a handful of other games, but have you ever used one for a driving game? What about a fighting game? Or a football game? The truth is, joysticks are too awkward to use with many different types of games. What you need for these games is a game pad.

We've tested six popular game pads to see which ones

Gamepad is an analog device in an increasingly digital world. To make matters worse, the pad does not allow you to program custom button configurations. Also, the pad's native Windows support is spotty.

The buttons themselves are nicely designed, with a top row of three convex buttons and a bottom row of three concave buttons making it easy to work by feel. Two more buttons are placed in the front of the unit. Unfortunately, the directional pad is a disaster. It's rotated off-center, possibly with the idea that it would align better with the thumb. Instead, it just feels crooked. Getting any fine degree of control from it is a real challenge. Also, all of the buttons make a lot of noise, particularly the directional pad.

Support for multiple pads is limited to two units linked by a Y cable. With a Y cable in place, each player can use only half the buttons on the pad.

CH normally makes high-quality, well-designed products like the Flightstick Pro and CH



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Pedals. But in the case of the CH Gamepad, the finished product feels as though it may still be in the development stages.—*T. Liam McDonald*

GamePad Pro



With its signature white plastic case and multicolored buttons, the GamePad, from Advanced Gravis Computer Technology, is so popular that it is still a best-seller after four years on the market. Will the next-generation GamePad Pro be as successful? We think so.

The GamePad Pro has four buttons on the right and two flipper buttons on the front of each stubby handle. The well-designed directional pad has a slot for a screw-in mini-joystick handle.

This pad is on the small side, so it may not fit as com-

fortably into large hands as the Microsoft SideWinder Game Pad. The GamePad Pro, however, is far more responsive, and we quickly grew accustomed to the pad's design. We like the fact that this product offers more tactile feedback on the directional pad than the others. Also, the Pro allows you to program the buttons to provide keystroke input for both Windows 95 and DOS games.

One of the GamePad Pro's best features is a built-in Y connector on the cable that allows you to plug in a second pad. But unless the game you're playing includes support for the GrIP Game System (reviewed below), you will be able to use only half the buttons on each pad.

The GamePad Pro may take getting used to, but we feel that it's the best game pad on the market.—*Shane Mooney*

GrIP Game System

Need more than one or two game pads for a game with your friends? Try the GrIP Game System. The first of the digital game-pad solutions, GrIP is a boomerang-shaped device that plugs into a standard game port to provide four digital and two analog ports.

The GrIP Game System includes a multiport unit and two digital controllers. If you have a game that includes native GrIP support (such as one of several Electronic Arts sports titles), you should be able to use most of a GrIP pad's eight buttons. You can also program each of the GrIP pads' buttons.

The system's two analog ports allow you to plug in your favorite joystick or other con-



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offer the best combination of ergonomics, responsiveness, and value. Though none were perfect (some, in fact, were downright disappointing), one product did set itself apart from the crowd.

CH Gamepad

We can't fault the CH Gamepad for its basic design, which is sturdy and ergonomically comfortable, but we can fault it for just about everything else.

To begin with, the CH

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After Hours

troller for games where game pads just don't cut it. Anyone who hates changing joysticks between games as much as we do should appreciate this feature.

Apart from the price tag (\$89.95 list), we were a bit put off by the design of the GriP pads themselves. Similar in appearance to the CH Gamepad, these pads are a bit too small for adult hands. Also, we found that the directional pad had too much play.

Still, the GriP Game System is a good choice for hard-



core game players with a passion for single-computer, multi-player games.—SM

Microsoft SideWinder Game Pad

Microsoft surprised just about everyone when its SideWinder 3D Pro joystick turned out to be a solid addition to a crowded market. The same cannot be said about the company's game pad.

The crescent-shaped Microsoft SideWinder Game Pad feels sturdy and fits nicely in the palms. It's festooned with buttons: Six main buttons sit on top, while two flipper buttons are set into the handles. The SideWinder also has start and select buttons, as well as a mode button that allows the use of another device plugged into its pass-through port.



Finally, a large macro button allows you to use preprogrammed button combinations for complex moves. You can also program each of the SideWinder's buttons to generate keystroke input.

Like the CH Gamepad, the SideWinder has a poor directional pad. It does not provide the fine sense of directional control necessary for driving and fighting games.

Though up to four SideWinder units can be daisy-chained together, the connection method is cumbersome. Still, the final, insurmountable failing of the SideWinder is its utter inability to function in anything but Windows 95.

With all this against it, even a slick design can't make the Microsoft SideWinder Game Pad a contender against Gravis or Logitech pads.—TLM

Phazer Pad

Though highly successful in the high-end flight-stick market, ThrustMaster has had problems in the more general controller arenas. The Phazer Pad doesn't figure to change this trend.

The Phazer is the second-largest game pad we reviewed. It is also the busiest, with four main buttons on top, two flipper buttons on the

front, two triggers underneath the flippers, separate start and select buttons, two mode switches, and a throttle control. We found this arrangement overwhelming.

When we limited ourselves to the directional pad and the four main buttons, we liked the Phazer Pad a lot. It's very responsive, and we found the directional pad and buttons comfortable. The pad works well under Windows 95 and DOS and is fully programmable under both. We did not like the amount of time it took to download a new set of custom commands into the pad, however (nearly 2 minutes for FX Fighter Turbo).

We also did not like the fact that the Phazer Pad plugs into the keyboard port and the game port. Particularly on PCs with DIN keyboard ports, the Phazer's snakelike array of plugs becomes annoying.

With some minor improvements, fewer buttons, and a lower price, the Phazer Pad would be a top-notch controller. As it stands, though, this pad is no match for the GamePad Pro.—MER

ThunderPad Digital

Logitech's ThunderPad Digital game pad is designed to provide maximum control without sacrificing comfort. In

our minds, it succeeds on both counts.

This sleek pad fits nicely into your hands. Four main buttons sit on top of the pad, with two mode buttons immediately to their left. Two flipper buttons located on the front of the unit round out the set. The design is simple, but it's comfortable enough that we were able to play for several hours at a time without having our hands cramp up.

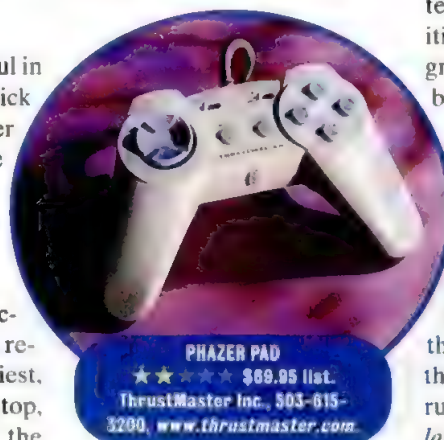
The buttons have a good feel to them, although the directional pad does not move quite as smoothly as we would



have liked. This resulted in less-than-stellar responsiveness when we attempted some complex maneuvers during fighting games. With driving and sports games, however, we were impressed with the ThunderPad's performance.

The included Logitech Entertainment Software is intuitive and allows you to program all of the ThunderPad's buttons. You can even set up the two mode switches as additional action buttons if necessary.

Overall, the ThunderPad Digital is an impressive product. With a more responsive directional pad, the ThunderPad would give the GamePad Pro a serious run for its money.—John Delaney and Michael E. Ryan



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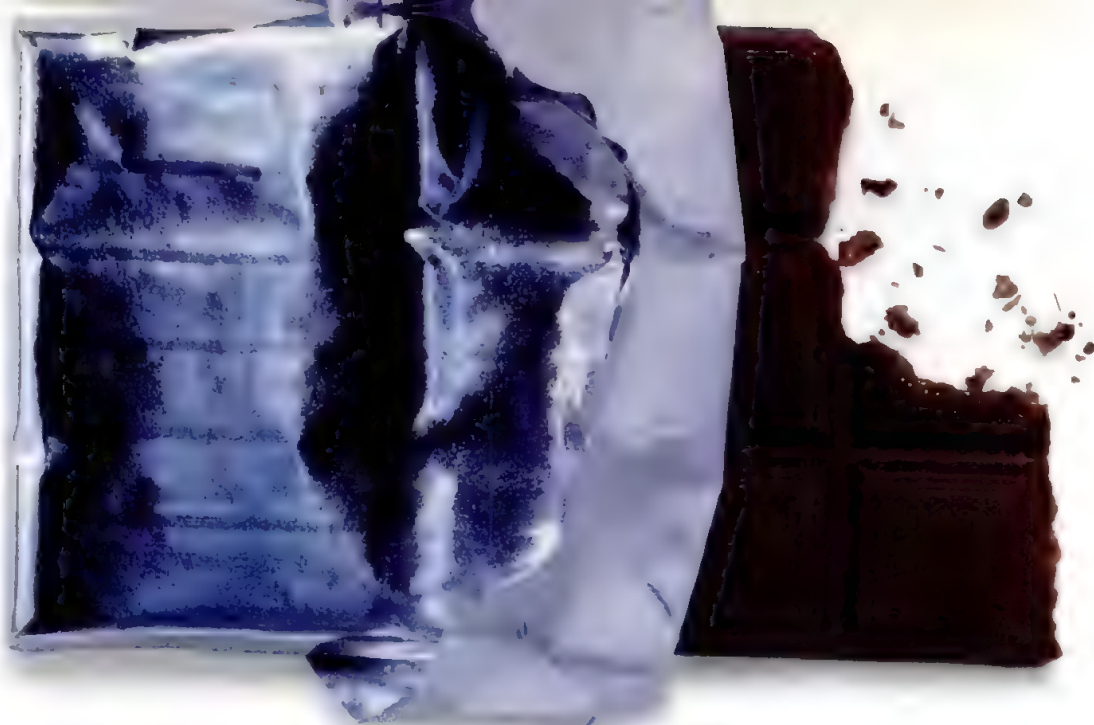
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7th Level enters the big-mech genre with a good-looking, action-packed winner.

G-NOME

With the successful MechWarrior 2 blazing a trail, several mech combat games have followed, each one scrambling to outdo the other. Now there's 7th Level's G-Nome, an impressive effort with some unique twists.

G-Nome is a Windows 95 action game that requires a Pentium/90 with 16MB of RAM and a 4X CD-ROM drive. For best results, however, we suggest running the game on a Pentium/133 or better.

Unlike most action titles, this one boasts a complex and compelling storyline, which brings a nice mix of missions with it. Your goal is to prevent the deployment of a secret biological weapon known as G-Nome.

One of the features that sets this game apart from the scores of other MechWarrior 2 wanna-bes is that during combat, you actually have to

leave your HAWC (Heavily Armored Weapons Chassis) and complete several missions on foot. The ability to leave your vehicle also comes in handy when your HAWC is severely damaged, because you can jump out and run off to steal an enemy's HAWC. Traveling on foot is risky, though; when a foot soldier battles a big, walking robot, it's not too difficult to guess who wins most of the time.

G-Nome also boasts an impressive graphics engine, one of the best in the business. Nearly everything in G-Nome is beautifully textured, including the HAWCs, terrain, and trees.

If you have an MMX-equipped machine, the game will take advantage of the technology to make things look even better. Cap things off with incredible sound effects and you have a truly memorable mech experience.—SM



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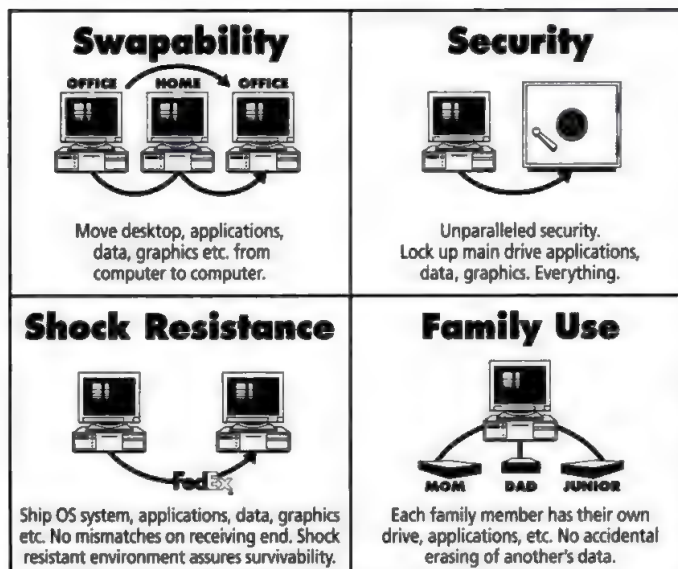
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Quaking On and On

Two expansion packs for Quake offer new creatures, new levels, and new weapons.

Quake Mission Pack No. 1: Scourge of Armagon

Remember the name Hip-notic Interactive. This company developed Quake Mission Pack No. 1: Scourge of Armagon, an expansion module for id Software's Quake that is even more impressive than the original game.

Scourge of Armagon (published by Activision) requires

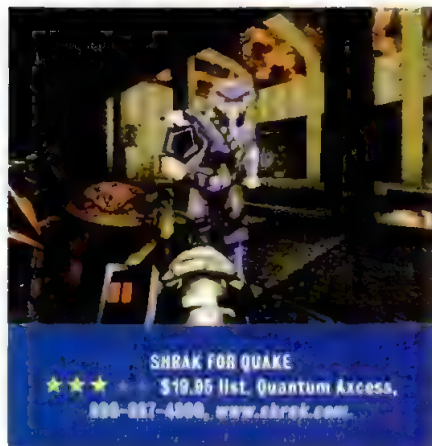
than the gelatinous blob in Quake.

New items in the game include the Horn of Conjuring, which calls up a random Quake creature to fight at your side. The proximity mine launcher and the laser cannon add new punch to the weapon selection.

You can even wield Mjolnir, the hammer of Thor, against

your enemies. Swing this potent hammer and a bolt of lighting shoots out to hit every enemy in your vicinity.

With such a solid combination of features and creatures, Scourge of Armagon is a must-have for any Quake fan.—MER



a full, registered copy of Quake. This pack tends to run out of memory on some levels when operated in high-resolution modes under Windows 95, so you should run the game with the command line switch "—winmem 12" to ensure stable play.

The pack includes 18 new single-player levels and one death match-only level. The level designs in Scourge of Armagon are spectacular and on a par with such complex classics as Dark Forces and Hexen.

Scourge of Armagon adds a few new creatures—weapon-stealing gremlins, mechanized scorpions, and an end-level boss far more intimidating

than the gelatinous blob in Quake. This pack tends to run out of memory on some levels when operated in high-resolution modes under Windows 95, so you should run the game with the command line switch "—winmem 12" to ensure stable play.

Like Scourge of Armagon, Shrak for Quake works only with the full, registered version of Quake. The product lets you rampage through 12 new single-player levels (designed around a Hexen-style central hub), 5 death match-only levels, and 1 secret level.

In addition, Shrak replaces Quake's weapons with nine new ones. Our favorite is the inflator dart gun: It causes foes to blow up like balloons and spin around in the air before exploding. Sick, but disturbingly fun. We didn't like Shrak's missile launcher, however, be-



cause it fires too slowly and is much wimpier than the regular Quake rocket launcher.

In general, the level designs in Shrak are good and sufficiently imaginative to stand out from the usual Internet-downloadable variety. The new monsters are of mixed quality, with the most impressive and terrifying being the

scorpion and the spider. You can even play as these insects in Shrak's Bug War multi-player scenario. We found the end-level monster (Shrak itself) rather silly.

While it is not nearly as impressive as Scourge of Armagon, Shrak for Quake does offer some very impressive new features.—MER

QUICK CLIPS

Command & Conquer Gold

 The Windows 95-only version of Westwood's classic has two selling points: new Super VGA graphics and expanded Internet capabilities. Nothing else worth mentioning has been added. \$49.99 list; Westwood Studios, 800-874-4607, www.westwood.com.

Barbie Magic Fairy Tales—Barbie as Rapunzel

 Will it break as many sales records as the first Barbie CD-ROM? Probably not, but this wonderfully animated interactive storybook is a lot of fun. It does not have as many clickable hot spots as most children's software, but it's sure to brighten the day of any young Barbie fan. \$30 street; Mattel Media, 888-628-8359, www.mattelmedia.com.



XS

 Another first-person stinker, this offers a lot of glitz during cut-scenes and menus but suffers from confusing, uninteresting game play and really bad polygonal graphics. \$49.99 list; GT Interactive Software, 800-610-4847, www.gtinteractive.com.

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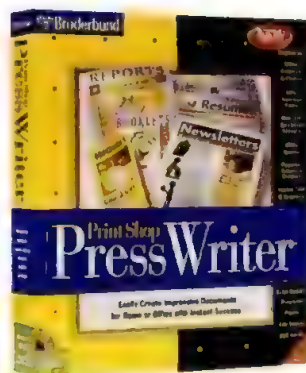
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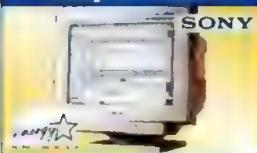
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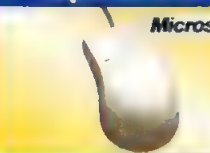
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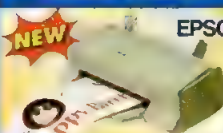
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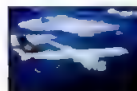
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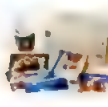


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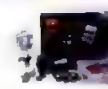
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It's the hottest topic in a hot industry: "Push" technology is all the rage in the online community—the idea that content you've requested is delivered regularly to your desktop instead of your always having to go looking for it. Push certainly appeals to lots of end users—and even more to content providers. But what does it mean in a business environment? We'll take a look at as we review the new push servers out on the market.

Java Tools

So, you want to jazz up your Web page with some Java animated spots. Fear not. You don't necessarily have to turn into a programmer. We'll review some user-oriented tools for creating Java animated spots for your Web page.

Network Printers

Printers for your network are getting faster and more sophisticated. We test 22 monochrome network laser printers aimed at small workgroups, departments, and entire organizations. There's even a few that aim to replace your copier.



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By Don Willmott

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If your entry is used, we'll send you \$50 and a PC Magazine T-shirt. Send your entries to Abort, Retry, Fail?, PC Magazine, One Park Ave., New York, NY 10016-5802 or via e-mail (text items only) to don_willmott@zd.com. Winners this issue: Mark Cutrell, Karen Donahue, Robb Erikson, Richard Hane, and Carl Sanders.

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